RADIO, TELEVISION and HOBBIES

Volume 23, Number 8 **November, 1961**

IDEAS BEARING FRUIT

THERE has been gratifying support for many of the opinions and proposals put forward on this page in recent months.

The idea of an "Industry Council," for example, has been widely commended. If there had been such a body in existence in 1957-58, the Federation of Commercial Broadcasting Stations might not have found it quite so easy to convince the Broadcasting Control Board that "there were very real, practical objections to the introduction of frequency modulation broadcasting." (I quote from the official report, reprinted on page 19.)

Some have questioned whether the Institution of Radio Engineers Australia is sufficiently flexible to initiate and support an Industry Council of the type which seems to be required. Whether this be the case or not, it is interesting to note that, within the last few weeks, the Institution of Electrical Engineers, England, has created a new post — that of a full-time Public Relations Officer. They state that creation of the new post is intended to facilitate interchange of information between the Institution, technological interests and the lay public.

Obviously enough, the Institution cannot have a Public Relations Officer, without having a policy to go with it, and provision to formulate that policy. If precedent is needed by the I.R.E. Australia, I can't imagine a better one.

The fate of FM broadcasting still continues to exercise the minds of private readers and trade identities alike. During the past month, for example, a meeting at managerial level of leading Australian radio manufacturers called on the Postmaster-General for an immediate resumption of FM broadcasting, using the "experimental" transmitters, and the allocation of available frequencies for more FM transmissions. It is to be hoped that the authorities take note of the signatories to this new representation.

And, of course, interest in the Citizens' Band proposition is rapidly gaining momentum. Equipment of both local and overseas manufacture is being offered for sale and members of the public are becoming aware that their needs could be met by simple two-way radio, even within the limitation of present regulations.

W. N. Williams

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Cover Picture:

Bell Telephones Laboratories' installation at Crawford Hill in Holmdel, N.J. has been dubbed "the telephone terminal to outer space." Signals were bounced from here, via a man-made satellite to the Jet Propulsion Laboratory in Goldstone, California. The transmitter, a 60-foot dish, is shown in the background. Nearer the camera is the unique "horn reflector" used as a receiving antenna and developed by Bell Laboratories. (See also story and pictures on page 17).

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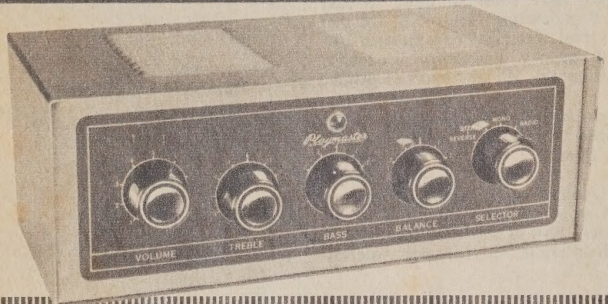

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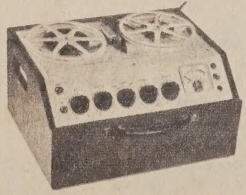

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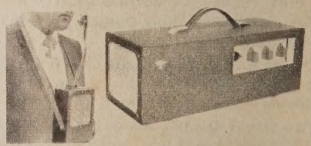

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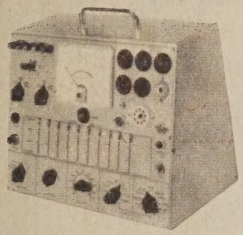

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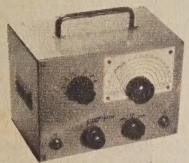

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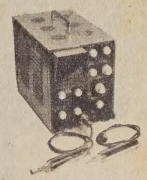

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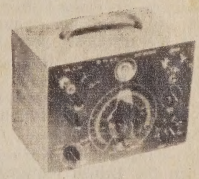

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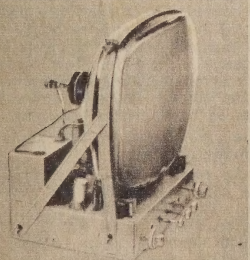

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The announcement that the Federal German Government is willing in principle to participate in a European organisation for the development of space vehicle launchers, as proposed by the United Kingdom and French Governments, has focused attention on the British Blue Streak first-stage launcher.

PLANS TO SEND "BLUE STREAK" INTO ORBIT

By David B. Pollock M.I.E.E., A.M.I. Mech. E.

ALTHOUGH the part that satellites and the mastery of space will play in the future cannot be wholly foreseen, the rewards to be gained from such applications as a satellite communication system are obviously great indeed.

The combined work of scientists and engineers at the Royal Aircraft Establishment, Farnborough, Hampshire, England, and other Government establishments and industry now gives Europe an opportunity of using existing knowledge to speed the program.

Work on the Blue Streak missile project was started in 1955. Then the British requirement was for a long-range ballistic missile. Nearly all the missile flight was to be ballistic, the velocity and direction of the missile being controlled by an autopilot and inertial guidance system during the first three minutes after launch.

To accelerate the progress of development, de Havillands, the prime contractor and co-ordinating design authority for the work, entered into an agreement for the exchange of information with what is now General Dynamics/Astronautics, San Diego, United States of America. A similar agreement was made between Rolls-Royce Ltd., and Rocketdyne Division, North American Aviation Inc., for the rocket engines. Blue Streak has therefore been able to take advantage of the experience gained in the design and development of the Atlas vehicle.

Blue Streak is basically a cylinder 10 feet in diameter, with an overall length of 60 feet. The weight, with fuel, is about 90 tons. The propulsion bay contains two Rolls-Royce rocket engines capable of giving a combined thrust of 300,000lb. They are pivoted on their mountings and, by gimballing, the vehicle can be controlled in yaw, pitch and roll.

Above this is the tank bay with separate storage for 60 tons of liquid oxygen and 26 tons of kerosene, which are the propellants for the engines. When used as a missile, the war head was connected to the top of the tank by a bay housing the inertial guidance equipment. This bay will now be replaced by a separation bay to which the second stage of the satellite launcher is attached.

In April, 1960, the Blue Streak Missile Project was cancelled. The basic missile requirements, however, were compatible with those of a first-stage satellite launcher and, almost from the start of the project, the possibility of using Blue Streak in a space role had been appreciated.

Accordingly, during the period following cancellation of the missile project, plans were made for adapting Blue Streak for a space role and work was directed to this end.

Already several vehicle structures have been manufactured at the de Havilland Aircraft Company's Hatfield works and complete vehicles assembled at the Stevenage works, both in Hertfordshire, England. The reliability of the Rolls-Royce rocket engines had also been demonstrated by several hundred successful firings.

Extensive development work on the vehicle systems and ground support equipment had been carried out at the company's Hatfield test site. This site is provided with storage tanks for holding 12,000 gallons of kerosene and 100 tons of liquid nitrogen. The latter is used to simulate the low temperature of liquid oxygen but without the same explosive hazards.

There are three towers at Hatfield. The first one contains heavy-duty liquid nitrogen and kerosene tanks, and the other two towers can accommodate complete Blue Streak vehicles. One of them is used for flow testing of the vehicle propulsion system, including the running of the turbines and propellant pumps. The other tower is designed for development tests on the launch release gear.

In addition there are laboratories and an instrumentation room with recording channels.

No firings of the rocket engines are possible at this site; these must be carried out either at Spadeadam or Woomera, Australia. The Spadeadam site, which is managed by Rolls-Royce on behalf of the Ministry of Aviation, covers roughly 10,000 acres of open country about 20 miles north-east of Carlisle. It was built at a cost of approximately £20,000,000, and has several stands for testing the Rolls-Royce rocket engines and components, and an almost finished test stand, known as C3, for captive firing tests of the complete Blue Streak vehicle.

Pending completion of the stand, an engine stand has been converted and has been used several times for captive firing tests of the completed vehicle. This test stand is a reinforced concrete emplacement with a flat-topped causeway on which a mobile servicing tower moves on rails.

The launching stand itself is at the end of the causeway and supports the vehicle during engine firing. Built into the emplacement is a steel flame deflector bucket weighing nearly 70 tons which is watercooled and deflects the burning gases into the horizontal plane. When a vehicle is to be erected, the service tower is positioned above the launching stand and the vehicle handling frame hinged to the launching pad. The vehicle can then be raised by winch into the tower, where hinged platforms at different levels give access for servicing.

The firing tests and preliminary check-out are controlled and instrumented from a large blockhouse which is 1,000 feet from the test stand, and is fitted with periscopes and closed-circuit television. There are approximately 24 control and check-out consoles, and a total of more than 200 separate channels are provided for receiving data which is recorded on charts and magnetic tape.

A cutaway diagram of the Blue Streak rocket which it is proposed should be used as a first-stage launcher for a European space satellite. The author states that the Blue Streak project, put in hand now, would be as up-to-date as any of its much publicised American counterparts.

The ground facilities include a liquid oxygen manufacturing plant capable of producing more than 100 tons of liquid oxygen and nitrogen a day. From the latter, gaseous nitrogen is obtained which is piped under high pressure to storage bottles at the various test sites. Water, which is primarily required for cooling the test stand deflector buckets, is pumped from a river three miles away to a central reservoir. After use in the deflector buckets it has to be treated in tanks to remove the kerosene before disposal.

The Woomera Rocket Range is a part of the Australian Weapons Research Establishement which already has considerable experience in missile and space work.

RANGE SYSTEM

The range system comprises a common down range zone and a number of vehicle preparation and launching areas. The Blue Streak firing stand and associated check-out and control equipment is practically identical with that at Spadeadam. The launcher, however, is mounted on four-wheeled bogie assemblies which run on a circular rail so that the vehicle can be rotated about its own axis to point in any direction for firing. The bogies are then retracted and the launcher clamped to the track.

Range facilities include optical and radar tracking equipment, range safety instrumentation, a variety of cine camera and kine theodolite equipment and telemetry receivers. Nearly all construction work on the site has now been completed.

The Anglo-French proposals for a European Space Launcher, which were issued at the Strasbourg Conference in February, 1961, envisaged using Blue Streak with a French-manufactured second stage and an unspecified third stage.

Using Blue Streak as the first stage of a three-stage rocket, weighing more than 100 tons, the vehicle would rise vertically for 20 seconds, climbing steadily to about 2,000 feet. It would then begin to turn over slowly until the desired trajectory angle, about 30 degrees to the horizontal, is reached. The vehicle's speed at this stage would be 2,500 miles per hour and its height nearly 18 miles. Blue Streak would then accelerate up a straight climb path until its speed reached 8,500 miles per hour and all its propellants were burnt. The calculated time from launch to first-stage burn-out would be about 160 seconds; its position 50 miles high, 80 miles down range. At engine cut-off the ignition process of the second-stage rocket would be started and it would then draw clear. The spent Blue Streak would fall in a ballistic path on its return to the surface, impacting almost 1,000 miles down range.

The French second-stage would increase the speed from 8,500 to 14,500 miles per hour along a straight line in space. This speed would be reached with the rocket some 250 miles down range and at a height of 105 miles. At this point the second stage would hand over to the third stage and begin a long fall back to earth. What is left of it after re-entering the atmosphere at this tremendous speed would impact about 3,000 miles down range from the launch.

When the third stage was fired, the rocket would be travelling at 14,500 m.p.h., 105 miles high and still be climbing. When this stage has completed its mission the satellite must be at orbiting speed and height, moving horizontally to the earth's surface for a circular orbit or climbing at the appropriate angle for its orbit. The final speed would be between 17,000 miles per hour for a low circular orbit and 24,000 miles per hour for high eccentric elliptic orbits.

For the optimum configuration discussed at Strasbourg, based on Blue Streak uprated to 300,000lb thrust, the French second stage and a hypothetical third stage, a satellite of 2,200 pounds may be put into a 300 mile circular polar orbit. Corresponding payloads for elliptical polar orbits, both with perigee heights of 300 miles and apogee heights of 7,000 and 10,000 miles are respectively 940 pounds and 320 pounds. For a high altitude circular polar orbit at 5,000 miles altitude, a payload weight of 500 pounds is calculated for this rocket configuration.

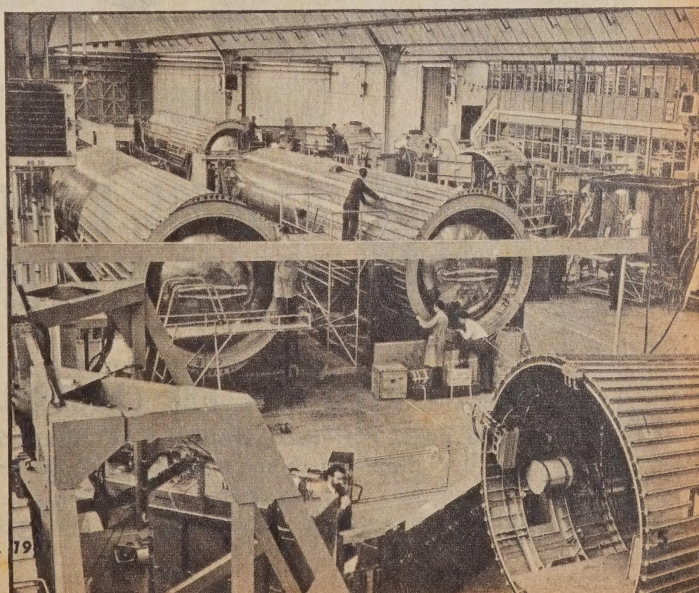
BETTER FUELS

An improvement in these payload weights could be obtained by using liquid hydrogen/liquid oxygen propulsion in the third stage. Development time would necessarily be longer than that of a hydrogen peroxide/kerosene design. Studies indicate that payloads of 3,400 pounds and 1,400 pounds would then be attainable for the 300 and 5,000 mile circular polar orbits using Woomera as the launching station.

The program proposed at Strasbourg for the first project covers five years development and provides for ten firings involving the first stage. The upper stages would meanwhile evolve from prototypes to final operating stages. The last three of the ten shots should be capable of projecting payloads into orbit.

These complete three-stage launchers would carry only test satellites designed for the primary purpose of establishing the ability of the launching vehicle to inject a satellite into orbit in a satisfactory fashion. Such satellites would be used to study questions such as the environmental conditions affecting the satellite during the powered flight of the launching vehicle, problems of separation of the satellite from the

Part of the Blue Streak production line at a Hertfordshire (England) factory of the de Havilland Aircraft Company Ltd. If the outcome of present plans is the establishment of a satellite communications network, it is claimed that the profits therefrom would, in 10 years, cover the costs to date of Blue Streak (£70,000,000) plus future committments.



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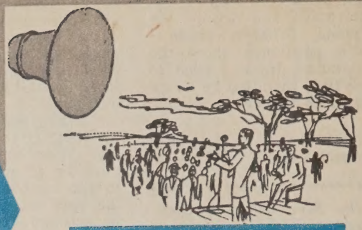

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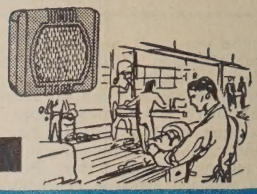

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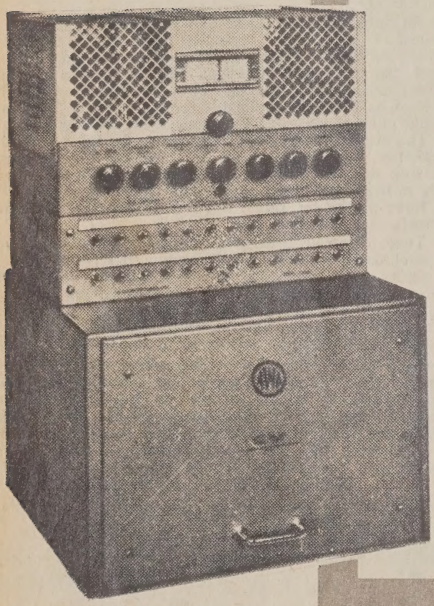

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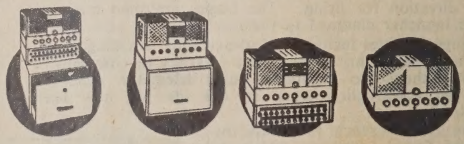

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third stage, and the residual motion imparted to the satellite by separation. They might also be used for simple scientific experiments or the carriage of components for test in space.

Apart from purely scientific uses, probably the most important commercial application of satellites is likely to be providing a world-wide satellite communication system. Recent Hawker-Siddeley studies indicate that a system of eight satellites could provide a world-wide communications system. If the total cost of rocket and satellite development is assumed to be twice the £70 million stated as having already been spent, profits from the communication system could cover this capital expenditure within about 10 years of operation. Other important commercial applications for satellites are likely to be for navigation and weather reporting.

The propulsion system for Blue Streak comprises two Rolls-Royce RZ.2 rocket engines. The engines in this installation are quite separate units, each with its own propellant feed, combustion and control system. The double engine installation in Blue Streak is designated RZ.12.

The original application of the RZ.2 was for the early development rounds of the Blue Streak ballistic missile. It was intended that the operational missile would be powered by a development of the RZ.2. Following the cancellation of Blue Streak as a weapon, work on these more advanced engines was terminated as studies of the Blue Streak as a satellite launcher showed that the existing RZ.2 engine would be entirely adequate for this application.

FUEL PUMPS

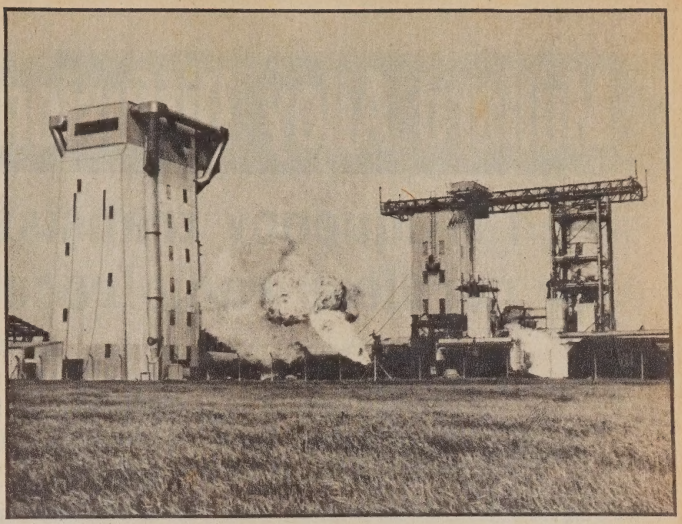
Each engine has a turbopump set which feeds the propellants to the thrust chamber. The latter is regeneratively cooled, being of tubular-walled construction, and the total flow of kerosene traverses the chamber walls before entering the combustion zone of the chamber. A complete engine weighs 1,500lb.

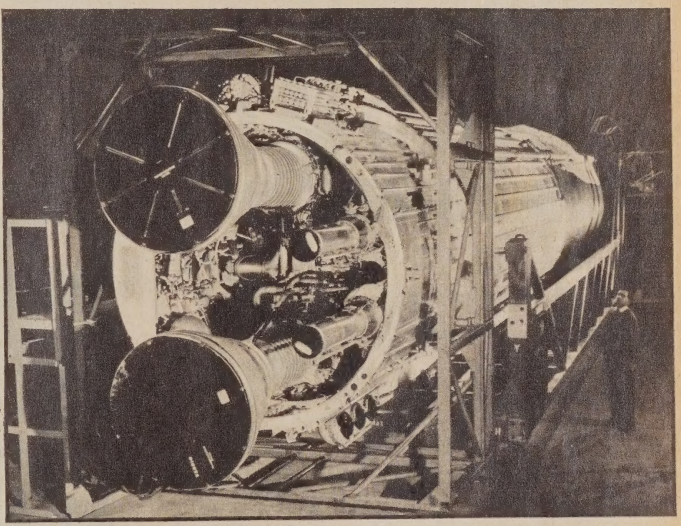
The propellant pumps are driven by a turbine via a simple spur reduction gear; the turbine is supplied from the separate gas generator, which burns a fuel-rich mixture of the propellants. Such a fuel-rich mixture is required to keep the temperature of the combustion gases down to a value acceptable in the turbine of about 650 degrees Centigrade. The mixture ratio to achieve this is about 0.35 (oxygen to fuel) by weight.

An electro-pneumatic sequential control system is used for operating the various valves during start and shut-down. This is a ladder-type system, in which any given operation cannot take place until a signal has been received signifying that the preceding operation has been satisfactorily completed.

Propellants for starting the engine are supplied from pressurised ground-mounted tanks, and ignition in the gas generator and thrust chamber is by pyrotechnic igniters.

A satellite launcher, based on Blue Streak, will be sufficiently powerful to meet all planned requirements and is as up-to-date in design as any of its American counterparts. Newer vehicles may possibly be able to put the same payload in orbit at slightly reduced cost, but when judged against the large outlay on development and ground equipment for a new vehicle, such savings are unlikely to be of importance for many years to come.

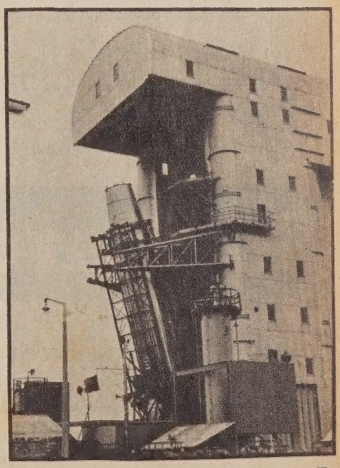




The picture at the top shows surplus paraffin being burnt from the exhaust of a gas generator on the Blue Streak test site at Hatfield. The tower at the left is used for testing the working of the launcher and release gear, while the two on the right are used to test flow characteristics of individual components within the system.

In the centre picture is shown the propulsion bay of the Blue Streak, with two Rolls Royce engines fitted with thrust chambers. The fuel tank to the rear of this section is ten feet in diameter and forty-six feet in length. The handling frame in which it rests is used both for transporting the vehicle and lifting it into position at the test stand.

A close-up picture of the test stand is shown at the right, with a Blue Streak "development vehicle" being lifted into position, prior to a captive firing trial.



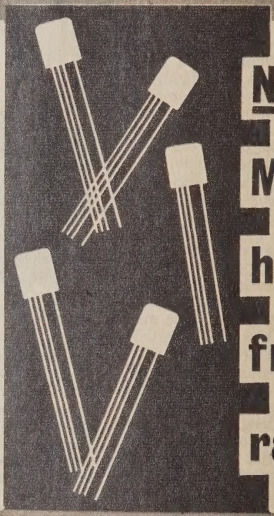
Mullard Alloy Diffusion Technique

high frequency transistors for cordless radio receivers

One of the most important recent advances in transistor technology is the alloy-diffusion technique used by Mullard. This technique provides transistors with uniform high frequency characteristics and enables the design of low cost cordless radios of superior performance.

OC169 - OC170 - OC171

Transistor Type	OC169	OC170	OC171	
Collector Voltage (Vcb max.)	—20	—20	—20	V
Collector Current (Ic max.)	10	10	10	mA
Max. Dissipation (25° C)	80	80	80	mW
Typical parameters at (measured at Vce = —6V, Ic = 1mA)	0.45 (common emitter)	10 (common emitter)	100 (common base)	Mc/s
Input Conductance	0.4	2.5	23	mmhos
Input Capacitance	80	65	—6	pF
Feedback Admittance	< 100	100	600	μmhos
Transfer Admittance	36	32	14	mA/V
Output Conductance	7	60	350	μmhos
Output Capacitance	7	4.5	2.6	pF
Ideal Unilateralised power gain	61	32	> 10dB	



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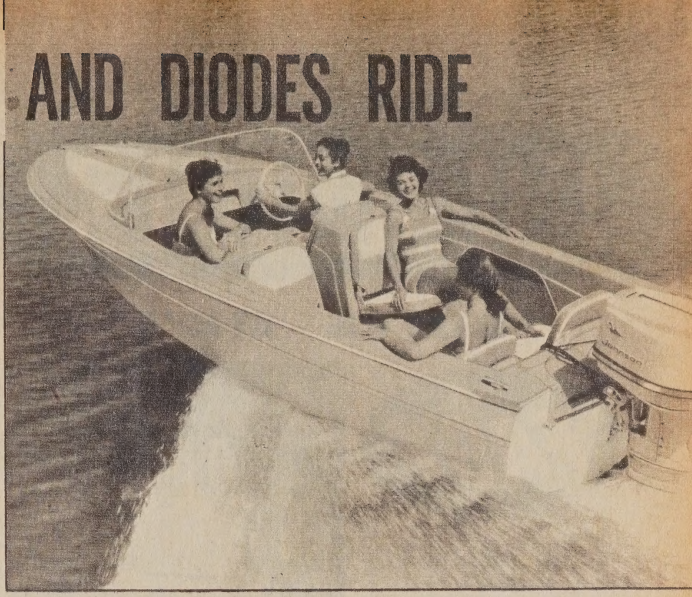
TRANSISTORS AND DIODES RIDE THE NEW OUTBOARDS

Electronics plays a part in most things these days, and pleasure boats are no exception. The electrical system of a modern boat is quite complex and this article tells how transistors and other solid-state devices have made possibe a revolutionary new approach to the problem; an approach which gives high all-round charging efficiency, combined with low maintenance and a high order of reliability.



Going boating this summer? If so you might like to know something about the electrical system used in modern boats, and the advances made in recent designs.

ALTHOUGH the system about to be described is intended for boat operation, the general principles involved have been applied to mobile electrical systems in general for some time. Initially they found application in large road vehicles, such as buses, lorries, etc., while, more recently, makers of larger, luxury type cars, particularly in the United States, have adopted the idea.

In all cases the change has been prompted by similar conditions; a rapidly increasing use of electrical appliances, ranging from radio telephones to air-conditioning systems, and the need to produce a compact and reliable power plant able to handle the increasing load.

Our story of a typical marine system comes from Outboard Marine Australia Pty. Ltd., manufacturers of the well-known Johnson and Evinrude outboard motors. The technical illustrations are by courtesy of Delco-Remy.

Outboard Marine Australia recently released two complete new ranges of Johnson and Evinrude motors, and the new electrical system has been incorporated in the 75 hp versions of both makes.

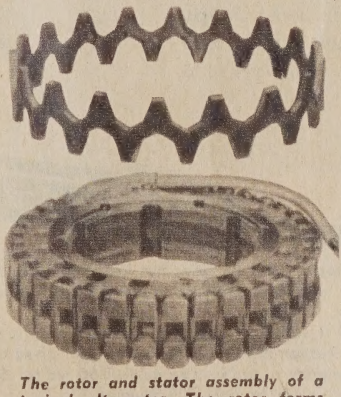
These powerful motors are now obtainable fitted wtih a revolutionary alternator for charging the batteries. More and more boat owners are fitting their craft with electrically operated accessories. These include bow and stern lights, horn, running and/or mooring lights, cabin lights, radio and electrical appliances, all of which impose an increasing strain on the electrical system.

The capacity of the alternator has been designed to meet these electrical requirements and to provide the necessarily high charging rate which may be needed.

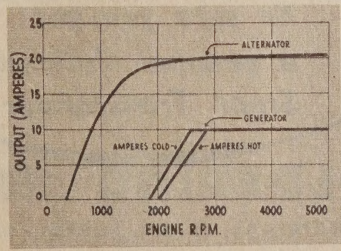
The main advantage of the alternator over the conventional DC generator is that the alternator requires no commutator. In the small units, such as the ones we are considering here, no moving contacts of any kind are required, while larger units need only a set of slip rings. Slip rings require negligible maintenance as compared with a commutator.

Particularly where high currents are involved, the commutator is a weak link, being prone to serious wear with consequent poor efficiency. With modern rectifiers it is much more logical to rectify electronically than mechanically.

The shape of an alternator also may be made more favourable, most designs favouring a large diameter and a thin section. This, in turn, favours building the unit directly into the motor, without coupling belts, chains or gears. And, by careful design, they may still be made to deliver useful output at relatively low speeds.



The rotor and stator assembly of a typical alternator. The rotor forms part of the flywheel and rotates outside the stator.



This chart shows the difference between the alternator and a conventional generator.

A glance at the charging rate chart will show the efficiency of the unit we are considering, in that it can charge at five amps when the engine is running as low as 600 r.p.m. and quickly builds up to 20 amps at just over 2,000 r.p.m.

The new alternator is thus superior to the conventional DC generator, which is not capable of charging at very low r.p.m. This is a very important feature in a boat, as quite often the motor is used at idling speeds for long periods, e.g., when trolling for fish.

There are two basic requirements in a battery-charger—first, that it shall have sufficient capacity to do the job, and, second, that the charging rate should be able to be regulated to suit the condition of the battery.

In the case of the Johnson and Evinrude motors the alternator unit consists of a stator assembled to the crankcase of the motor and a rotor of irregular shape brazed to the inside of the flywheel rim. The stator is made up of a soft iron laminated core or frame, designed as illustrated to accommodate the field and stator windings.

The field winding, which is energised by the battery, consists of a single winding of many turns wound laterally around the core. The stator coils are wound at right angles to the field coil around the pole segments, of which there are 36 pairs, and consequently 36 pairs of stator coils. The adjacent windings are wound in opposite directions.

The associated circuitry may possibly be more easily understood if considered in two sections, namely, the field circuit and the charging circuit. In the diagram shown the charging circuit occupies the left-hand side and the field and associated control circuit the right-hand side.

When turning the ignition/starting switch key to "START," the field circuit is connected to the battery supply

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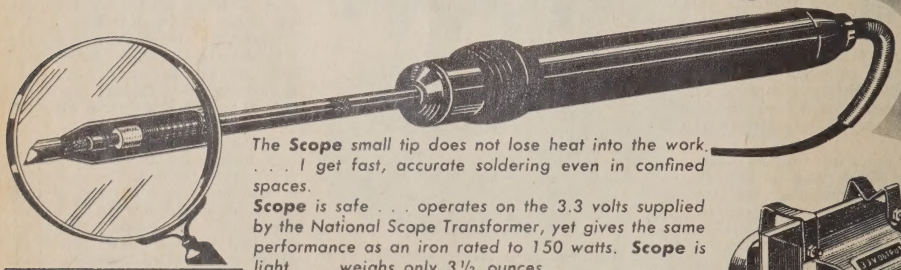

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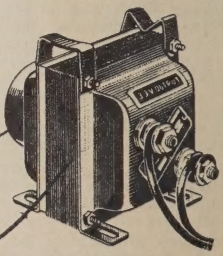

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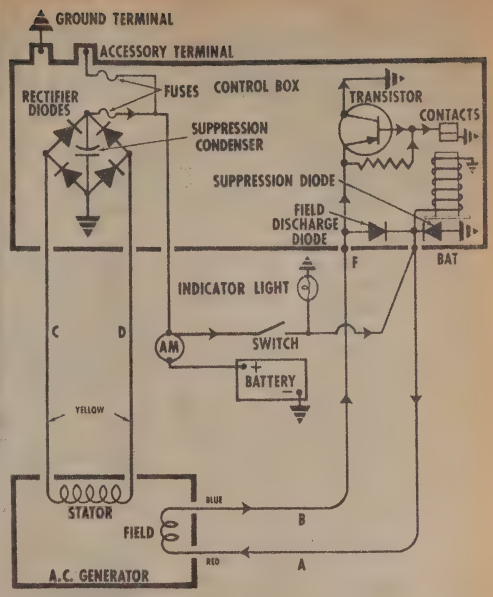
and a current flows through the field coil on the stator, the transistor (described later), and through the earth return back to the battery.

When the field coil is energised as described above, the core becomes magnetised with the upper row of pole segments assuming NORTH polarity and the lower, SOUTH polarity. A magnetic field builds up around these poles as shown in the sketch. The irregular shaped rotor, as it revolves with the flywheel around the stator poles, passes through intermittent areas of variable magnetic field strength.

The effect of this is to vary the strength of the magnetic field around the stator windings, inducing current in them, first in one direction and then the opposite. The result is an alternating current alternating 36 times per revolution or, at 1,000 r.p.m., 36,000 cycles per MINUTE. In more familiar terms, 600 cps at 1,000 r.p.m.

Such an alternating current cannot, of course, be used as such to charge a battery, but must be rectified to convert it to direct current. The schematic diagram shows that this is accomplished with a bridge type rectifier circuit using silicon diodes. These diodes are a revolutionary advancement in the rectifier field in that while they are comparatively small, they handle large currents and, in addition, are very robust.

Inasmuch as current output of the alternator remains high at nearly all motor r.p.m., a means to limit resultant output or charging rate must be provided to maintain a charging rate within acceptable capacity of the battery.



Complete circuit of the electrical system described in this article. The main charging circuit is on the left hand side and the field control circuit on the right.

DANGEROUS CONDITION

Without a limiting control, it would obviously be possible for the charging rate to reach such proportions as not only to endanger the battery, but the entire electrical system — wiring, ignition, accessories, etc.

Since the alternator r.p.m. is governed by the operator's hand at the throttle, a transistorised voltage regulator, operating in the field circuit is used to control stator field intensity and, as such, achieve a charging rate compatible with capacity of the battery and wiring system.

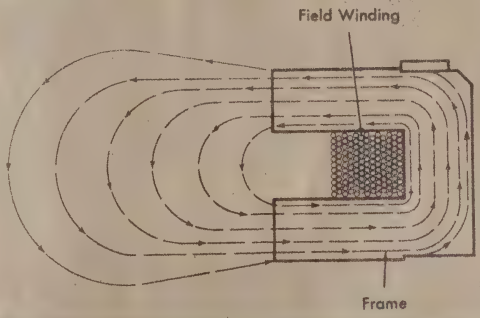
Reference to the schematic circuit shows how this is done, the relevant section being the transistor and the contacts in its base circuit. These contacts are normally held closed by carefully adjusted spring tension, but will open when the associated coil, wound on an iron core, is sufficiently energised.

This coil is connected directly across the battery and the spring tension is so adjusted that, when a certain critical voltage is reached, the contacts open. The actual voltage at which this occurs varies slightly with different systems, but will be one which indicates that the battery is receiving the maximum rate of charge for its condition. Typical values would be based on 2.4 volts per cell, or about 14.4 volts for a nominal 12-volt battery.

USE OF TRANSISTOR

So far, this arrangement is not greatly different from that used in conventional car charging circuits, where similar contacts are used to control the generator field energising current. The main advance lies in the use of a transistor between the contacts and the field circuit. By using the transistor to handle the relatively heavy field current, the contacts need handle only a very small current, and their life and reliability is vastly increased.

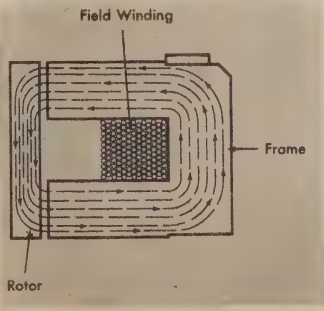
In greater detail, the transistor operation is as follows: While ever the contacts in the base circuit are closed, the base is at the same potential as the collector, i.e., the transistor is "forward biased." In this condition it will pass maximum current from emitter to collector and, in turn, through the field winding.



The diagrams left and below show the magnetic field around the stator when (left) there is no rotor across the pole pieces and (below) when the rotor completes the magnetic circuit. Changes in field pattern with rotor position induce current in stator windings.

However, when the contacts open, the base assumes the same potential as the emitter and, lacking forward bias, very little current can flow from emitter to collector and through the field winding.

In this latter condition, charging virtually ceases, the voltage across the battery drops, and the coil is no longer capable of holding the contacts open. Thus, charging recommences, and the whole cycle is repeated. The rate at which this occurs—or, more correctly, the ratio of "charge" to "no-charge" periods—determines the true charging rate of the battery, and is an effective way of providing any required average rate, even though the instantaneous rate can only alternate between maximum and a very low value.



In turn, the correct charge rate is determined automatically by such factors as the battery's state of charge, the load across it, current available from the charging circuit, etc.

For example, a battery which is approaching full charge, under no load conditions, will maintain a high voltage across its terminals for a relatively long period after the field contacts have been opened. Thus the "off" period will be long and, when the contacts finally close, only a short "on" period will be needed to raise the voltage again and open the contacts.

If a heavy load is now connected across the battery, the voltage will drop, charging will commence, and probably will continue while ever the load remains. A lighter load may allow the battery to assume a full charge condition even while it is present, thereby allowing the field circuit to be opened once again. However, because the battery is loaded, its voltage will drop rapidly when charging ceases, the "off" period

(Continued on Page 111)

REPAIRING, REBUILDING HUMAN BODIES

One of the most intriguing facets of modern medical treatment is the knowledge and skill which has been brought to bear in the field of plastic surgery. While many major problems yet await an answer, the fact remains that plastic surgeons are doing a great deal to ease the lot of people whose bodies have been impaired by accident, deterioration and deformity.

English migrant, Henry Steadman, 14, could use his left hand at only 50% efficiency, because of the loss of his thumb in an accident. A Melbourne plastic surgeon successfully moved over his forefinger, turning it around, while maintaining nerves and blood vessels intact, and joined the bone and tendons to those which had belonged to the thumb. It is anticipated that the hand will be resored to 90% of its original efficiency.

By Calvin Walters

TO be quite frank, while browsing through medical journals in search of material for last month's article on heart surgery, I came across so much interesting material that I had the urge, there and then, to write a whole string of articles about recent developments and discoveries in the field.

But, editors being what they are, I know beforehand that half of the articles would have been returned with a curt note requesting "more variety of subject matter—or else!"

So, plastic surgery it is — the technique which mends bodies mutilated by war or by accident; which reworks noses and ears for people who are dissatisfied with the ones nature gave them . . . and so on.

In fact and fiction, we have all read about the transformation of an ugly woman into a work of art by means of the surgeon's scalpel; of television stars who have their faces altered so that the cameras will not accentuate certain unwanted features; of wives who have won their husbands back from the wobbly path by having a face-lift.

We have read about hunted criminals having their features altered to escape detection and so on, ad lib.

During the two world wars, very remarkable things were done by plastic surgeons of all countries in rehabilitating wounded soldiers, not only by mending broken faces, but by healing extensive wounds and burns by means of skin grafts.

Since the advent of the greatest killer and maimer of all, the motor car, plastic surgery has done some wonderful things for people mutilated in accidents.

Plastic surgery is not a new science. It was practised in some measure hundreds of years B.C. by various "surgeons" of the more enlightened countries of the day.

The Hindus were particularly good at one particular type of plastic surgery. This was the provision of new noses to fellows who were caught in the act of coveting another man's wife and who suffered the penalty imposed for that sort of thing, namely the cutting-off of the nose.

Several techniques were used at that time, notably that of using flaps of skin from the cheeks, or of cutting a triangular-shaped flap of skin in the forehead and turning it down to form a nose. In those days, there were fellows who wandered about the country mainly with the idea of restoring noses in this way.

The famous Tagliacozzi of the fifteen-hundreds was the first surgeon to use the technique of stitching the patient's arm to the site of the new nose until the skin of the arm grew on to the face. The piece of flesh was then cut away from the arm, leaving it on the face, where it was subsequently moulded into the new rose. A similar technique is used at the present time.

The transplanting of skin cut from one part of the body to another part had to wait until the advent of antiseptics, but a French surgeon developed this type of graft in 1869. It is known as the tree skin graft. The type of graft mentioned earlier and practised by the Hindus is called the "flap" or "pedicle" type, but more about this anon.

This woman underwent treatment at the hands of plastic surgeons and beauty specialists in New York. The photograph was taken at a stage when treatment of one side of the face was complete.

One of the difficulties of grafting skin on to large wounds or burned surfaces is the fact that the skin used must come from the patient.

Skin taken from another person will not "take." Even if skin is taken from another person of the same blood group, the grafts will grow well for a couple of weeks and then, suddenly, within a few hours, the skin will disappear. It doesn't just fall off, it just disappears, apparently being absorbed by the body.

This presents a big problem, because in many cases the patient cannot afford to lose more skin than he has already lost by burns.

Scientists have been tackling this problem from several angles, but so far have not solved the problem, although some results have been encouraging. One method tried is to immerse the skin from another person for some time in blood plasma taken from the patient.

Generally speaking, the process of skin grafting, which is the basis of all plastic surgery, consists merely of cutting skin from one part of the body and growing it on another part.

Where skin only is required, it is shaved from the source by means of a special machine called a dermatome. At one time, the whole thickness of skin was used. This left unsightly scars at the site of removal and made it impossible to take skin from any portion of the face.

With the dermatome machine, only a part of the full thickness of skin is shaved away and used, so that the wound made at the "donor" site heals up without leaving an unsightly scar.

This method is called the "split thickness" method and, by it, any desired thickness of skin can be used. A comparatively small area of skin can be split up into a large number of very thin pieces, whose total area is very much larger than the original.

At one time, the pieces of skin were attached to the new site by means of hundreds and even thousands of very

small stitches. These invariably left tiny scars after removal. It was also necessary to keep the graft under pressure until it "stuck."

This was not always a satisfactory process, because of the difficulty of keeping the pressure constant all over the area.

The result was that secretions from the wounded area accumulated under the graft, thus preventing it from sticking.

Science came to the rescue by discovering that blood contained "thrombo plastic" substances which would clot blood plasma. The substance is recovered by breaking up the white blood cells then mixing this with blood plasma. This is painted on to the sheet of skin, which is then merely stuck into place, the plasma mixture acting like glue but through which the blood vessels can penetrate from the tissues into the new skin.

PEDICLE PROCESS

One of the most fascinating processes of skin grafting is that referred to before as the "pedicle" process. This is employed where whole thicknesses of skin must be used.

If the graft must take place on the face, it is obvious that whole thicknesses of skin cannot be taken from the face itself, because another scar would be left as a further disfigurement.

It is therefore necessary to take the whole thickness of skin from some place which is not usually open to the public gaze. Various parts will no doubt suggest themselves to the imaginative reader but let us assume that the skin is to be taken from the shoulder blades.

The size of the skin required is accurately calculated. Let us suppose it is to be a piece two inches wide by four inches long.

This piece is not cut straight out of the shoulder blade as one might imagine. Instead, the two four-inch sides are cut along with a scalpel leaving the two ends of the rectangle uncut.

The skin is then separated from the tissue by running a scalpel underneath the skin. This leaves a flap of skin separated from the tissue but still attached at both ends like a strap loop on a suitcase.

The two four-inch sides are now drawn together and their edges sewn together. This protects the raw bleeding surface of the skin, and produces what looks like a small suitcase handle.

MOVING THE PEDICLE

One end of this "pedicle" is now cut from the body, leaving the other end still attached. We now have a stalk of folded skin still being nourished by the blood entering it from the end which is still attached. This stalk can be bent in any direction.

An incision is now made further along the shoulder and closer to the face by the length of the stalk.

The free end of the stalk of skin is inserted into the incision and secured by a stitch or two. In a day or two it takes root. It is now four inches closer to where it has to go. After it has securely taken root and examination shows it to be still healthy skin, the end furthest from the face is detached, the stalk rolled over on its end and the free end secured in an incision four inches further towards its destination.

In this way the pedicle of skin is transported end-over-end until it is close to its new location. Here the wound or whatever it is, is excised, the stitches on the pedicle of skin are cut and the skin is unrolled and fixed into position over the wound which it has to cover.

It will be seen that the pedicle of skin was in continual attachment to the body during its journey from the back to the face. There is therefore little chance of its dying on the way, as it is continually being nourished by blood vessels which grow in to it.

This process takes a long time, of course, which is something of a drawback. Where speed is essential for the patient's welfare, a more cumbersome but speedier method of transferring the stalk must be used.

VIA THE ARM

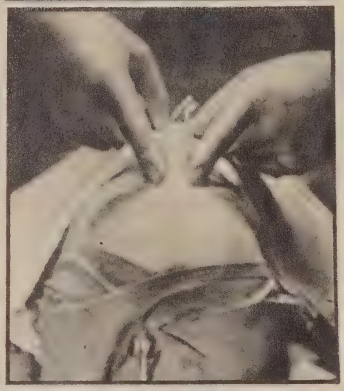
If the stalk is to be taken from the back, it makes one or two steps over towards the shoulder. The arm is then folded up and the stalk transferred to there. From the arm it is transferred directly to the face.

Unfortunately, this means that the patient must have his arm attached to his face until the stalk takes root at the site of the graft.

The time can be shortened still further by taking the stalk from the abdomen or chest, either directly to the face by a couple of steps or via the arm. The site chosen from which to take the skin depends on several circumstances and is always chosen by the doctor to suit such circumstances.

It will thus be seen that the above method makes it possible to transport living, healthy skin from any part of the body to another. The method is particularly useful in grafting skin on to leg ulcers which have to be removed.

Readers can visualise for themselves how it is now possible to form new noses, ears and so on by means of trans-



A bad fracture had left this patient with the badly disfigured nose shown in the upper photograph. In the lower photograph, the bones have been re-fractured with a special pincers-like tool. The English plastic surgeon is applying pressure to push the pieces into position, and give the right overall contour.

☆

The start of an actual grafting operation, aimed at transferring skin from the abdominal wall to a badly burned hand. The hand is placed in the position it will occupy until the transfer has been effected. A flap, corresponding to the area marked out on the hand, has been affixed to the abdomen and used to mark out the exact area and shape of skin required.

BOEING "FIR-TREE" TURBINE WHEEL

THE Boeing Industrial Products Division has started production of the new fir-tree turbine wheel for the company's T50 gas turbine engine. These are among the smallest fir-tree wheels produced today. The term "fir-tree" describes a turbine wheel with mechanically attached blades or buckets. Both the 7-inch diameter 66-blade gas producer and 9-inch 50-blade power turbine wheels in the Boeing T50 turbine are of fir-tree construction.

The Boeing fir-tree turbine wheels which turn up to 38,000 r.p.m., were formerly of welded construction. The turbine wheel hub shown is broached from an Inconel X forging, a high temperature high strength material requiring special production techniques. Fir-tree assembly will allow replacement of damaged turbine blades. Each blade, made of GMR-235 material, is held in place by a metal key. The Boeing 750 is a 270 shaft horsepower turbine.

Plastic Surgery . . .

porting living tissue to form the basis upon which the new appendage is moulded.

Similarly, by cutting the inside of the mouth, the cheeks can be moulded into different shapes. By cutting the scalp and lifting the skin, wrinkles on the forehead can be stretched out, the eyebrows lifted showing a look of perpetual surprise, or they can be lowered to give a perpetual frown!

But it is not only in the fields of skin grafting that plastic surgery has made great progress. The replacement of bones or the alteration of contours has been brought to a high degree of accuracy.

For instance, jawbones, cheekbones and the cartilage of the nose can now be replaced by the skilled surgeon.

One most ingenious method makes use of the fact that cartilage, when powdered into small pieces and inserted into living tissue, will knit together into a solid fibrous mass.

Use is made of this in restoring cheekbones and the gums of the mouth. In fact, it can be made use of in any place requiring restoration of bone and cartilage structures.

The method is to crush cartilage taken from the ribs into thousands of small pieces. These are placed beneath the skin where it is desired, the skin stitched together and the whole covered with a latex rubber mould of the desired final shape.

The cartilage beneath the skin welds together into the shape of the mould. It is like filling the defect with living plaster of Paris.

Another outstanding example of the plastic surgeon's art is a process now called "cineplastic amputation." This is a method of making attachments to the extensor and flexor muscles of an arm which has been amputated, so that fingers of an artificial arm or hand can be used in a similar fashion to the real thing.

MUSCLE COUPLINGS

For reasons of infection and so on, it is not possible to connect living tendons to any mechanical gadget, so means had to be devised to make the muscles themselves act upon some other mechanism which can be pulled up and down and so work the artificial fingers.

The procedure is as follows: When an arm is amputated, the surgeon cuts a flap of skin several inches above the amputation and over the group of muscles which control the action of the fingers. One end of this flap is left attached. The flap is now rolled into a tube with the skin side in and the raw side out.

A slit is now made through the muscle and out to the other side. Through this is pulled the tube of skin. Where the tube emerges from the other side, the edges are stitched to the edges of the hole from which it emerges. We now have a hole through the muscle lined on the inside with skin.

After healing is complete, a peg is inserted into the tube and this is connected by a bar or wire to the extensor or flexor mechanism of artificial fingers. When the extensor or flexor muscle exerts its influence, the peg to which the wires or bars are attached moves up or down the arm and so controls the fingers.

People provided with such an artificial device may not be able to play the piano, but they can certainly do much more than they could before.

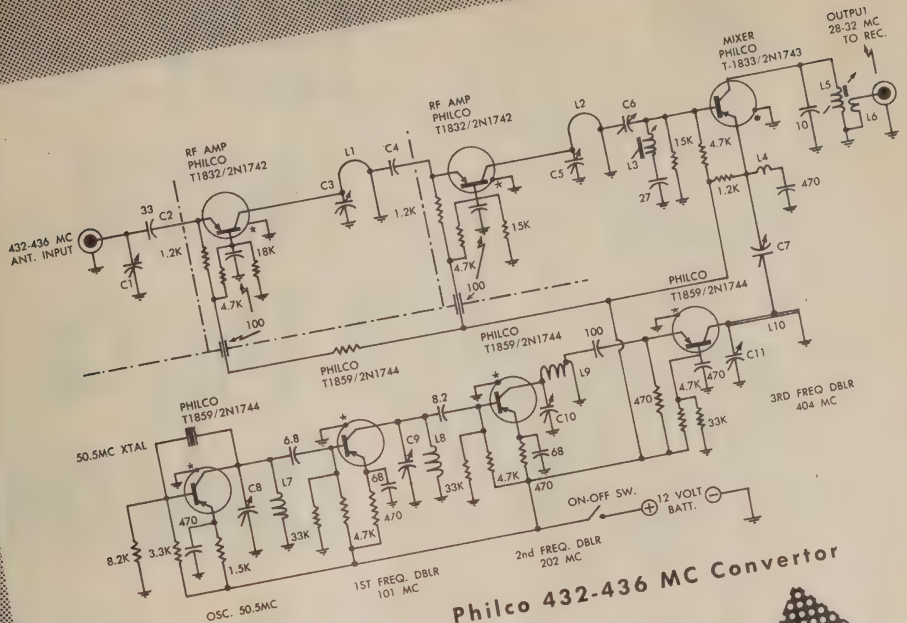
MAKING A LIP

People who have had an accident resulting in the loss of the upper lip, or who have no lip because of a congenital defect, may have a new lip provided by a plastic surgeon in a similarly ingenious manner.

By taking a strip of scalp skin from above the hair line, grafting a thin piece of skin on the under side to act as a mucuous membrane, the scalp skin can be grafted into place, thus forming a new lip complete with moustache.

There is a tough fibrous tissue which covers the muscles of the leg. This is used in plastic surgery to fix on to position on the cheekbone inside the mouth. To this can be attached the cheeks, which may have been caused to sag from paralysis. Thus they can be lifted and maintained in a normal position by tissue from the leg fixed inside the mouth, where it is not seen. Tantalum wire is also used for this purpose.

(Continued on Page 109)



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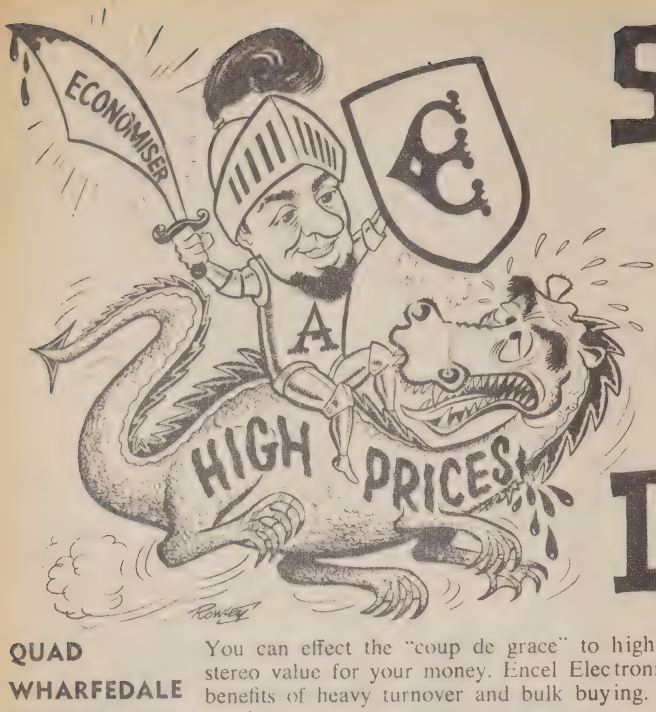

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BRITISH - AMERICAN PROJECT TO TEST COMMUNICATION SATELLITES

Following initial successes with satellite communication, British and American engineers plan to co-operate closely to evaluate the technique and possibly to develop it to the point where it becomes a major medium of international communication.

AGREEMENT to this end has been reached by the British General ost Office and, for the United States, y the National Aeronautic and Space dministration and the American Tele-hone and Telegraph Company.

A spokesman for the British Post ffice, announcing the agreement, stated hat the anticipated successful outcome f the joint venture would bring much earer the day when television pro-rams could be relayed all over the orld.

With several satellites in orbit, for xample, it would be possible to have ositive communication at all times ithin the British Commonwealth.

British equipment, being readied for he proposed tests in early 1962, in-ludes an 85ft steerable parabolic an-nna at the G.P.O.'s new research ation in Cornwall. It is planned to nd television pictures and speech from is station to the American Telephone nd Telegraph Company station ATTOCS) in Maine, U.S.A.

At Rumford, Maine, The Bell Tele-hone Laboratories are currently con-ructing a huge horn antenna (See rticle on page 13, October 1960 issue) hich will be protected by the largest flatable "radome" yet made. Measur-ng 210 feet across and 161 feet high, it supported internally by compressed ir at low pressure. The dome, of syn-etic rubber and fabric, provides ade-uate weather protection for the an-nna structure and personnel but is mpletely transparent to radio waves.

People and vehicles entering the en-osed area must do so through air locks.

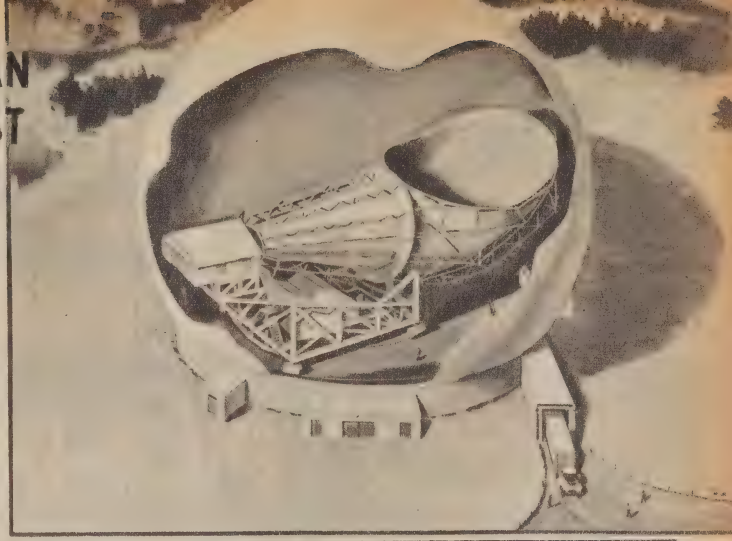
The ultimate plan is to equip the ell installation with five radome pro-ected antenna systems of this type. wo at least are necessary to maintain ninterrupted communication involving ore than one satellite. Before one tellite "sets" below the horizon, the cond antenna must have established ommunication and transferred traffic another which has "risen" mean-hile.

Another pair of radomes will be ecessary for a second major circuit, hile a fifth is envisaged as a spare, to brought into service while other units e undergoing maintenance.

One of the problems which engineers ant to resolve has to do with the lative merits of "passive" or "active" tellite repeaters.

The passive type is simply a large etallised sphere, which acts like a mir-

(Continued on Page 61)



(ABOVE) Artist's illustration of the Bell System's radome-protected horn antenna at Mumford, Maine.

(RIGHT) A developmental model of an active repeater satellite at the Bell Telephone Laboratories, with engineer Robert J. Neilson placing in position an assembly of solar cells. The cells are completely covered by thin slices of synthetic sapphire to protect them from unwanted space radiation. Satellites like this are likely to have a useful life of about ten years.

(BELOW) Five huge radome installations are planned for the complete Bell System's installation.

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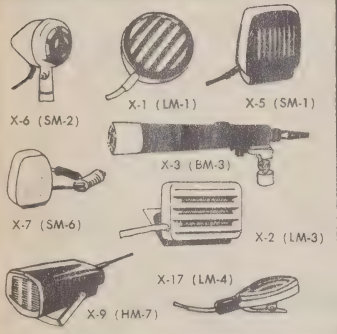
MICROPHONES and PICK-UP ARMS

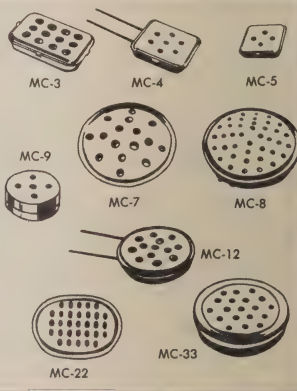


CRYSTAL MICROPHONES

Model	Type	Mounting Screw	Cartridge	Material	Cord	Dimensions Max. W.H.T.	Weight (g)
X-1 (LM-1)	Lapel	—	MC-7	Pressed brass	5 ft.	1.6" x 0.75"	46.0
X-2 (LM-3)	Lapel	—	MC-3	Urea resin mould	5 ft.	1.3" x 1.8"	60.0
X-17 (LM-4)	Lapel	—		Zinc diecast	5 ft.	1" x 2.2" x 0.81"	52.0
X-3 (BM-3)	Stand	5/8"	MC-9	Aluminium diecast	Without cord	1.3" x 8.5"	230.0
X-5 (SM-1)	Stand	5/16"	MC-8	Aluminium diecast	5 ft.		
X-6 (SM-2)	Stand	5/8"	MC-8	Aluminium diecast	5 ft.	2.2" x 3" x 3.2"	163.0
X-7 (SM-6)	Stand	5/16"	MC-8	Aluminium diecast	5 ft.		
X-8 (HM-1)	Hand	—	MC-8	Urea resin mould	5 ft.		
X-9 (HM-7)	Hand	5/16"	MC-3	Aluminium diecast	5 ft.	2.1" x 1.5" x 3.1"	119.0

CRYSTAL MICROPHONE CARTRIDGE

Model	Sensitivity (db)	Response (~)	Impedance (pf)	Material	Dia.	Dimensions D.	W.	H.	Weight (g)
MC-3	– 5 7	50 – 7,000	2,200	Pressed steel	—	1.378	1.004	0.315	7.0
MC-4	– 6 2	100 – 5,000	950	Pressed steel	—	1.126	1.126	0.213	6.0
MC-5	– 6 5	100 – 5,000	950	Pressed steel	—	0.867	0.867	0.197	4.0
MC-7	– 5 6	100 – 6,000	2,200	Aluminium	1.536	—	—	0.433	6.0
MC-8	– 5 0	50 – 8,000	2,200	Zinc diecast	1.890	—	—	0.670	31.0
MC-9	– 6 8	50 – 10,000	2,200	Zinc diecast	1.004	—	—	0.374	8.0
MC-12	– 5 5	50 – 8,000	2,200	Pressed steel	1.437	—	—	0.276	8.0
MC-22	– 5 5	50 – 9,000	2,200	Pressed steel	—	—	—	—	9.5
MC-33	– 6 0	50 – 15,000	1,000	Zinc diecast	1.24	—	—	0.26	17.0



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Technical Review

AUST. BROADCASTING CONTROL BOARD REPORT ON FM

Following the recent controversy concerning the termination of FM broadcasting services in Australia, we are reprinting this report from the Thirteenth Annual Report of the Australian Broadcasting Control Board, page 19, paragraphs 42 to 45. This sets out the main reasons which governed the decision.

IN several previous reports, the Board discussed the possibility of supplementing the broadcasting services provided by stations in the medium frequency band by the operation of stations using frequency modulation (FM) in the very high frequency (VHF) band. Experimental FM transmitters had been established in Sydney and Melbourne in 1947 before the Board was appointed and transmitters were subsequently established in Brisbane and Adelaide.

FM CONSIDERED

The desirability of introducing FM services on a permanent basis was considered by the Board on several occasions but the Broadcasting Act 1942-1948 prohibited the use of FM by any commercial broadcasting station. This prohibition was repealed in 1956, by which time plans had been made for the commencement in the latter part of that year of television services in Sydney and Melbourne.

The Board considered that these developments necessitated a thorough investigation of all the technical and economic factors which would be involved in the introduction of FM services. Accordingly, the Board decided to hold a public inquiry into the question and, as required by the Broadcasting and Television Act, 1942-1956, gave public notice in the Press of its intention to do so.

The inquiry was held in Sydney and Melbourne in August and September, 1957, and was adjourned at the request of the Australian Federation of Commercial Broadcasting Stations until April, 1958, when officers of the Federation gave further evidence.

The evidence given to the Board was such as to make it plain that, in the circumstances then prevailing, there were very real practical objections to the introduction of frequency modulation broadcasting. The remarkably rapid development of the television services and the necessity to provide sufficient VHF channels for the expansion of the services throughout the Commonwealth raised additional problems.

At the time, 10 VHF channels were available for this purpose, but when the Government decided in 1959 to extend television to 13 provincial and country centres, and to provide at the outset for a national and at least one commercial station at each centre, it became clear that 10 channels would be insufficient to make adequate provision for the ultimate development of television throughout the Commonwealth.

The extraordinary popularity of television in the capital cities and the desire for alternative programs had demonstrated a likely need for a greater number of stations in the various centres than had been previously envisaged.

This problem was thoroughly investigated by a technical conference convened by the Board in April, 1960, as part of its inquiry into the applications made for commercial licences for 13 provincial and country areas. The conference was attended by several of the applicants, a number of manufacturers and representatives of the Post Office, the Australian Broadcasting Commission and the Commonwealth Scientific and Industrial Research Organisation.

One of the questions considered was whether adequate space could be found for the expansion of television within the VHF band or whether a partial or complete transfer to the UHF band might be necessary. The general view of the conference was that television should be expanded within the VHF band and that the Postmaster-General should be requested to ascertain how many VHF channels could be made available for this purpose.

In its report to the Government dated August 1, 1960, the Board, after considering the views of the technical conference, expressed the view that 13 VHF channels would be necessary for the ultimate development of television and that the 92-108 Mc/s band which had previously been reserved for FM broadcasting might, if necessary, be used to provide two of these television channels. The Board felt that the only alternative to making sufficient VHF channels available for television was to use channels in the UHF band immediately, a course which had been strongly opposed in many quarters and which experience overseas had shown to have inherent disadvantages.

In the meantime, the Postmaster-General had announced his intention of appointing a Radio Frequency Allocations Review Committee to examine the allocation of frequencies for all types of radio services. That Committee, which was set up under the chairmanship of Professor L. G. H. Huxley, was asked to suggest, among other things, methods by which additional frequencies could be obtained for television.

CONCLUSION

After careful consideration of the claims of the various services, the Committee concluded that only by using the band of frequencies which had been reserved for FM broadcasting could 13 channels be reserved in the VHF band for television and reasonable provision be made for the growth of essential fixed and mobile services.

Following the adoption of the Committee's recommendation, it was decided to discontinue the experimental FM transmissions in the VHF band on June 30, 1961, for reasons which were explained in a statement issued by the Postmaster-General on May 31, 1961.

NATIONAL TV IN RURAL AREAS

The Postmaster-General (Mr Davidson) recently announced dates for the opening of the 13 national TV stations in rural areas. They as follows:

Canberra—December, 1962. Newcastle—April, 1963. Wollongong—September, 1963. Orange—October, 1963. Richmond-Tweed—April, 1964. Bendigo—April, 1963. Ballarat—May, 1963. Latrobe Valley—September, 1963. Goulburn Valley—November, 1963. Darling Downs—July, 1963. Rockhampton—September, 1963. Townsville—October, 1963. Launceston—July, 1963.

The statement went on to say that tenders had been called for the erection of transmitter buildings at Canberra, Ballarat, Bendigo, Goulburn Valley, and Launceston. Invitations for tenders for the Wollongong and Orange buildings were about to be announced.

Orders had been placed for the 13 transmitters for delivery between April, 1962, and April, 1963. Relay equipment was also on order.

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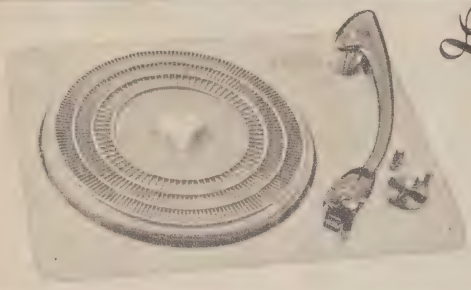

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You Could Qualify For a Transceiver on 27Mc.—Right Now!

By The Editor

Perhaps we don't, as yet, have full "Citizens' Band" facilities in this country—but don't despair! If you have a definite need for a low-power two-way radio link, there's an excellent chance of you being able, right now, to buy equipment to meet that need, and to obtain the necessary licence from the Postmaster-General's Department.

AS we pointed out in an earlier issue, a very large number of people are currently using two-way mobile radio equipment in Australia, ranging from essential services like the Police, Fire Brigade and Ambulance, to private business activities such as taxis, television repair vehicles, delivery vans, and so on.

Such systems operate in the V.H.F. region and, because they have been able to establish a suitable order of priority, either enjoy the use of an exclusive channel in the particular area, or else share a channel with a limited number of other users. To meet their needs, a wide range of equipment is available, much of it manufactured in Australia.

However, there are many citizen groups or business concerns which have a need for two-way radio communication but not so urgent or so frequent as to warrant an allocation in the already crowded VHF "mobile" bands around 80 and 170 Mc.

Even if this were no problem, the equipment commonly manufactured for use on the VHF mobile bands is much too elaborate and expensive for purely occasional use.

In the United States and, more recently in Canada, the licensing authorities have met the problem by allowing citizens to purchase and operate approved low-powered portable and/or vehicular mobile equipment in a series of channels adjacent to 27 Mc.

No order of priority need be established by an applicant for a licence and the equipment can be used for personal or business purposes or a mixture of both. The general approach of the licensing authorities is to allow the facility to be substantially self-regulating, within its particular frequency domain, while imposing no more control by regulation than is necessary to prevent obvious malpractice and abuse.

AUSTRALIAN NEED

"Radio, Television and Hobbies" has already expressed the view that similar facilities should be made available to Australian citizens and we are hopeful that they may ultimately be granted.

In the meantime, however, the facility exists within the framework of present P.M.G. regulations and policy for many Australian citizens to own and operate low-powered transceivers. What is no less important, they can obtain suitable equipment at relatively low cost, designed to conform to overseas "Citizen Band" requirements.

Some of these equipments, in the form of "handie-talkie" type transceivers have already been granted type approval, as conforming to Australian technical requirements. They are single channel units, crystal controlled for both transmit and receive and must operate, as allocated, within the frequency-limits 27.12 Mc plus and minus 0.6 per cent. In round figures, this corresponds to a total band width of 26.95 to 27.28 Mc, which just about coincides with the present—and largely unused—"11 metre" amateur allocation.

During recent weeks, members of "Radio, Television and Hobbies" staff have had the opportunity of testing some of these type transceivers under varied but typical conditions.

Measuring about 6¼ x 3 x 1¾ inches, the units are completely transistorised, have a power input to the final RF amplifier of about 100 milliwatts and operate from self-contained torch cells giving an estimated service of 150 hours under typical conditions.

They are fitted with a telescopic aerial, which measures something over 40 inches when fully extended but which collapses completely into the metal case of the unit.

SIMPLE TO USE

Operation calls for no special skill. The aerial is merely extended and the unit switched on by means of the combined volume control/off-on switch. It is then ready for operation, the volume control affecting only the loudness of the incoming signal. Under good conditions, the in-built loudspeaker reproduces the signal at much the same volume as any small transistorised receiver; under poor conditions, the unit can be held to the ear, much like a telephone receiver.

To transmit, it is merely necessary to press the "Transmit" button and talk into the loudspeaker, as one would into a telephone. Modulation depth is pre-set.

The range of these very low powered transceivers varies enormously with conditions and terrain.

They operate in a portion of the frequency spectrum (27Mc.) where auto ignition and electrical interference is extremely serious and, close to highways and neon signs, etc., this interference will quickly swamp all but very strong incoming signals. Under the worst conditions, with bad interference and between tall buildings, the range may diminish to a few hundred yards.

In open suburban areas, performance is much better and communication is possible over maximum distances varying between a half-mile and one and a half miles. In fact, better figures than these were obtained in some tests, possibly due to topography and possibly to transmission of the signal along intervening wire circuits, such as power and phone wires, etc.

In open scrub country, devoid of electrical or other wiring, one mile seemed to be about the limit for reliable communication, though one could probably do better operating between vantage points and to operating schedules.

Over water paths, the range multiplies enormously. Across portion of Tuggerah Lakes, at two miles, the signals were at maximum strength. Across Botany Bay, at five miles the signals were still very strong, contact being effected at six miles, with some land intervening.

It must be stressed that these figures are for hand-held type transceivers, having a power input on transmit of not more than 100 milliwatts and using receivers which are devoid of any noise discriminating circuitry.

Range would be improved by the use of a more powerful transmitter, a more refined receiver and a more efficient aerial system. Better equipment, even at one end of the link, would improve matters and it is interesting to note that the P.M.G. Department is currently prepared to license transmitters with power ratings up to 1 watt in the aerial, equivalent to about 1.5 watts of DC input to the final RF amplifier.

MORE EXPENSIVE

However, against this, it must be remembered that more powerful equipment will also be more expensive and more bulky, with much greater demands on battery power than the presently available transceivers. Distributors are currently reviewing equipment available in this higher powered class, to discover its suitability for local needs.

In the meantime, sufficient of the available equipment has already been licensed to indicate the type of use

With the rapid expansion of television, sweep generators, oscillators and vacuum tube voltmeters are now basic essentials in service workshops. Since the purchase of such equipment involves a substantial outlay. Jacoby, Mitchell offers a

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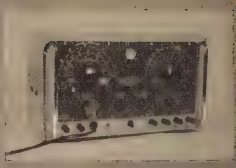

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for which the P.M.G. Department will normally grant approval. If you are concerned as a citizen with these and similar activities, and want two-way radio facilities, there is every chance that you will be granted official permission to use equipment of approved design—right now!

The following examples are typical only and do not exhaust the range of uses for which approval may be granted:

- Bushwalkers, hikers, etc.
- Cave explorers.
- Boat to boat at sea, for messages relating to movements and safety only.
- Officials controlling sporting functions.
- Television aerial installation.
- Rigging, building, construction and maintenance work.
- Doctors, in connection with their practice.

FAVOURABLE CONSIDERATION

Amplifying these typical approved uses, it is understood that the department will favourably consider any application for which the prospective user has a legal and specific purpose.

It will not grant approval in cases where it is considered that the intended use is "frivolous" or "irresponsible."

A further guiding principle is that the use of the equipments shall not constitute a major revenue conflict with PMG/OTC services already set up. This places an immediate restriction on the use of 27Mc. equipment for ship-shore communication, for which services and allocations already exist on other frequencies.

The department has requested equipment suppliers to acquaint all prospective purchasers of their transceivers of their responsibilities in regard to licensing. Further, that the supplier furnish the department with details of all sales to ensure that correct licensing procedure is followed.

Notwithstanding the above, it is the responsibility of anyone desiring to use transmitting equipment to apply for — and receive — a licence before the equipment is placed in service. The licence fee costs £1 per unit.

HOW TO APPLY

Application for a licence must be made in writing to the Superintendent of the Radio Branch at the General Post Office in the appropriate Capital City. Information required includes:

(1) Full name and address of applicant.

(2) The precise purpose for which the equipment is required and where it shall be used.

(3) Where involved, the nature of the business undertaking requiring to use the equipment.

(4) The number of transceivers to be used and the maximum distance and/or area over which communication will be required.

(5) The exact type and model number of the equipment which it is proposed to use and the frequency on which it is adjusted to operate.

Following receipt of the licence, prior approval must be obtained from the department if it is desired to alter or replace the equipment, to transfer it to another person or to another location or to vary, in any way, the conditions covered in the licence.

CITIZEN RADIO SERVICE IN CANADA, NEW ZEALAND

Canada has recently set up a Citizen Radio Service, closely resembling the system operating in the United States. New Zealand, too, has an officially recognised Citizen Radio Service and advice to hand from the Director-General of the New Zealand Postal Services (Mr D. Donaldson) indicates that, except for the number of channels available, the New Zealand Citizen Service is also similar to the American Class D Service.

DETAILS of licensing procedure and requirements regarding equipment for the New Zealand Citizen Radio Service are set out below:

LICENCES. Licences may be issued to any British subject 16 years of age or over. It is NOT necessary to state the purpose for which the equipment is to be used. They will be issued at engineers' offices only.

CALL SIGNS. Call signs are to consist of a code of the post-office where the engineer's office is established, followed by the licence number, e.g., AK27, RO96. The call sign is to be announced at the opening and closing of each transmission and at least once every 10 minutes during lengthy transmissions.

LICENCE FEE. The licence fee will be £1 per annum in respect of each set of equipment (combined transmitter-receiver).

EXAMINATION. No operator's examination will be required. The licence will include authority to operate the equipment.

THIRD PARTY TRAFFIC. The licensee will not be permitted to undertake service for any third party.

FREQUENCIES. Spot frequencies of 26.5Mc (plus or minus .02 per cent) and 465Mc (plus or minus .01 per cent) are available for the Citizen Radio Service.

TYPE OF EMISSION. Telephony only. Amplitude, frequency or phase modulation may be used.

BANDWIDTH AND MODULATION. (a) Amplitude modulation must not exceed 100 per cent nor shall the bandwidth exceed 6 Kc.

(b) Frequency modulation or phase modulation bandwidth must not exceed 36Kc.

All emissions outside the bands concerned shall be attenuated at least 40db below the maximum level of emission within the band.

POWER OUTPUT. When 10 per cent modulated with a frequency of 1,000 cps (sine wave) the maximum power innput to the final RF stage shall not exceed 1 watt for 26.4Mc working, or 10 watts for operation on 465Mc.

ANTENNA. The antenna shall be a whip type not exceeding 10ft.

FORM OF APPARATUS. Equipment may consist of separate transmitter and receiver units, combinations in one unit of separate transmitter and receiver circuits, or a switched circuit using common components serving both purposes.

EFFECT OF VOLTAGE CHANGES. (a) Mains operated equipment. The frequency tolerance should not be exceeded if the mains voltage is varied plus or minus 10 per cent.

(b) Battery operated equipment. The tolerance should not be exceeded over the entire range of battery voltage within which the equipment will continue to operate.

CONTROLS. No external control for the adjustment of transmitter frequency shall be permitted. Operation of any other controls fitted must not affect the transmitter frequency.

TYPE APPROVAL. All equipment is to be type approved by the Post Office and capable of use only on those frequencies allocated to the Citizen Radio Service. The fee for type approval of a set is £10. A transmitter, for which a licence is required, must bear an indication that it or one of its type has been submitted to and approved by the Director-General.

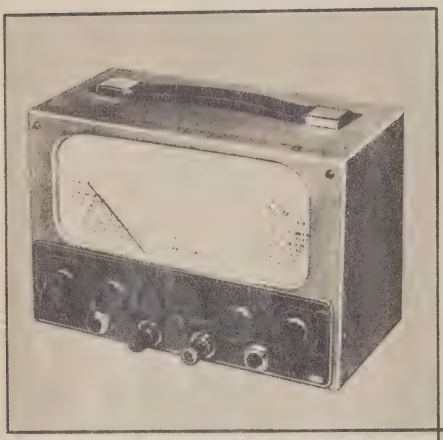
The sample of the apparatus requiring type approval should be forwarded to the Engineer-in-Chief, Radio Section, Wellington East Post Office Building, Wellington. A covering letter should be forwarded to the Director-General, Radio Division, General Post Office, Wellington, together with the fee.

Upon completion of the type approval testing, the equipment will be returned at owner's risk with an indication of either the type approval number or the reason for non-approval. If it is required to return the equipment to the Post Office for type approval after being suitably modified, a further fee of £10 will be payable.

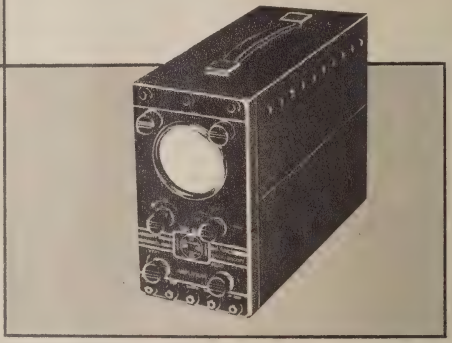
On type approval having been granted for a particular unit, it is to be understood that all future units produced bearing an indication of such approval, must conform with the original.

ALTERATION AND MAINTENANCE. No transmitter bearing an indication that it has been approved for use in the Citizen Service may be altered without prior reference to the Director-General. Internal maintenance may be carried out only by the holder of a first- or second-class radiotelegraph operator's certificate or a first- or second-class certificate in radiotechnology endorsed for radiotelephone working.

TV TEST INSTRUMENTS by University Graham



Electronic Volt Ohmmeter (V.T.V.M.)
Model TVR-EV. This smartly styled electronic Volt Ohmmeter is suitable for TV and radio servicing and employs a large 8-inch illuminated meter. It will measure negative D.C. voltage, positive D.C. voltage and A.C. voltage in steps of 1, 3, 10, 30, 100, 300 and 1,000 self-contained. Peak-to-peak A.C. voltages may be extended to 30,000 volts by use of the external probe resistance up to 1,000 megohms and the D.C. voltages can be extended to 30,000 volts by use of the external probe Model TV30. Crystal probe and valve probe enable RF voltages up to 1,000 to be checked, and the wide frequency response makes it entirely suitable for TV servicing and other application.



Oscilloscope 3-inch, Model TVR/C3
Small and portable, this Cathode Ray Oscilloscope is invaluable for TV and radio service work as well as industrial use. Although compact in size, it contains the features of larger instruments, is flexible in use and offers many new features. It is suitable for the visual alignment of TV receivers, and direct access is possible to both horizontal and vertical plates for examination of strong voltages. It can be supplied with a demodulator probe for signal tracing work in TV chassis. Vertical amplifier response plus or minus 1 db from 15 cycles to 150 kC/s and 6 db down at 1 megacycle.

TV Servicemen!... and Service Organisations

You are invited to inspect our television and radio test equipment under working conditions at our factory, 5 North York Street, Sydney, in a special demonstration room. We are situated in one of the arches under the Harbour Bridge, with easy parking facilities.

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SCIENTIFIC & INDUSTRIAL NEWS

PLASTIC MILK BOTTLES

FOR an experimental period, housewives in various parts of the Netherlands are to have their milk delivered in plastic bottles. These are made from polypropylene and manufactured by a Dutch firm on an extrusion machine of its own design.

Several advantages are claimed for the new plastic bottles. They are much lighter than the corresponding glass bottles and noise during stacking and transport is greatly reduced. With an average life of 400 fillings, they are also practically unbreakable and therefore safe to handle.

Lastly, since their height and dimensions are the same as those of glass bottles, dairies can continue to use existing filling, cleaning and sealing machines.

[Fabriek van Grafische Machines Meaf, V. Randwijckstraat 49, Yerseke, Holland.]

ADHESIVE PAPER

AN adhesive paper designed for protecting electrical and many other types of industrial equipment consists of a specially but lightly impregnated paper of the flatback type to which a rubber-based adhesive is attached.

The rubber latex resin of this adhesive is said to give a low but even adhesion to virtually any type of smooth surface.

At the same time it is specially designed so that it leaves no stain. Moreover, the nature of the adhesive and the exceptionally good abrasion-resistant properties of the paper surface enable drawing, pressing and other types of forming operations to be carried out while the surface is still fully protected by the paper.

One reason for this is the fact that if in, say, a drawing operation, the paper should split, a resilient and cohesive film is left which is said to give the surface full protection, but which can yet be readily removed. The paper can be readily written on, or for that matter, rubber stamped.

[John Gosheron and Co. Ltd., Packaging and Industrial Tape Centre, Albert Embankment, London, S.E.11, England.]

SONIC CONTROL SYSTEM

NEW equipment employs sound waves beyond the hearing range of the human ear to operate a "sensing" and switching system on production lines.

The system will detect solids or liquids, ferrous and non-ferrous metals and can be used to "watch over" both slow and fast-moving objects. The beam can be several feet wide and will operate through holes as small as 0.03 inch in diameter. It can also be made to go round corners by piping it through a tube.

Known as the Sonac system and originally developed in the United States, the equipment is unaffected by ambient light, dust or steam and because the acoustic beam is invisible it cannot easily be interfered with.

The equipment is claimed to be suitable for many applications, including automatic counting, package routing, level control, positioning and sorting.

It consists of a control unit containing a transistorised amplifier, plug-in output relay and power supply and two hermetically sealed acoustic sensors. One sensor acts as a transmitter and the other as a receiver.

[Westool, St. Helen's, Auckland, Co., Durham, England.]

CLEANING GASES

DUST-LADEN gases and industrial vapours may be cleaned efficiently for recirculation using modified filtering equipment developed in the Netherlands.

The equipment, consisting of a single apparatus, combines a centrifugal separator with a cloth filter. The gas or vapour to be cleaned is fed into a cylindrical chamber where it comes into contact with a rotor around which the filter cloth is stretched.

The zig-zag contour of the rotor — which is shaped roughly like a star — ensures that the gas is whirled around and that the heavy dust particles are separated out by centrifugal force. The finer particles are removed as the gas passes through the filter.

Since the cloth also rotates, it too is subjected to the action of centrifugal force and, as a result, is virtually self-cleaning.

[N. V. Bronswerk, Wemstraat 91, Amersfoot, Netherlands.]

HYDRAULIC GUN

FOR cutting rocks or for similar tasks associated with underground mining work, a compact hydraulic gun has been developed by Russian engineers which can cut through reinforced concrete at high speed.

Weighing half a ton, the gun throws out a pulsating jet of high-pressure water (15,000lb per square inch). Further development, it is reported, is now being undertaken with a view to increasing the pressure of water and consequently the gun's cutting speed.

[Further information from "Ekonomicheskaya Gazeta" of April 1, 1961 page 5, cols. 4-5, article by A. Kosar (in Russian). Copies from D.S.I.R. Lending Library Unit, 20 Chester Terrace, London, N.W.1, England.]

GARDEN FERTILISER

A GERMAN company has developed a fertiliser which releases nitrogen to the soil as and when required. It is recommended in particular for lawns and need be applied only once a year.

The fertiliser has a pure nitrogen con-

SINGLE HEAD VIDEO COLOUR RECORDER

ON page 19 of our last issue, we described the operation of a recently developed Japanese single-head monochrome video tape recorder. The equipment pictured above is basically similar but has been adapted for full video colour recording — the first time this has been achieved with a single-head machine. It was demonstrated in Tokyo by the Tokyo Shibaura Electric Company. The unit is claimed to be simple to operate and adjust and is free of many peculiarities encountered with the four-head system of recording.

TAPE RECORDER HISTORY!

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Australia's only tape recorder specialists, now offer machines on exclusive guarantee of:

LIFE-TIME FREE SERVICE

A golden seal, exclusive to Magnetic Sound, will be attached to tape recorders carrying the outstanding life-time free service benefit.
This golden seal represents the ultimate in reasons why you should buy your tape recorder from Magnetic Sound Industries.
Magnetic Sound Industries specialise in tape recorders and carry the largest range in Australia—over 50 different models for you to choose from.

TAPE RECORDERS from 59 Gns. or £8/10/- Deposit

GRUNDIG TK28

catalogue No.	104/TK28WE
tracks	4
max. spool	5½
tape speeds	1⅞ and 3¾ i.p.s.
freq. response	1⅞-50 to 8,000 c.p.s. 3¾-50 to 15,000 c.p.s.
output	2½ watts (stereo playback with one extra amplifier)
push buttons	record, trick, Mono 1-2 Mono 3-4 Mono D stereo
playing time	12 hours
dimensions	14 x 13-1/5 x 7-1/3 ins.
weight	25lbs. (11.5 kg.)
price:	169 gns.

PHILIPS EL3542

catalogue no.	116/EL3542
tracks	4
max. spool	7 ins.
tape speeds	1⅞, 3¾ and 7½ i.p.s.
freq. response	1⅞-50 to 7,000 c.p.s. 3¾-50 to 15,000 c.p.s. 7½-50 to 20,000 c.p.s.
output	2½ watts
stereo output	to suitable amplifier
stop	automatic
volume and tone	during recording in-built P.A. system
playing time	16 hours
dimensions	15¾ x 13 x 6¾ ins.
weight	30 lbs.
price	149 gns.

REMEMBER:

- **Free-of-interest terms are available—ask us about them.**
- **Your money refunded if you're not satisfied.**
- **Our salesmen are specially trained—they know tape recorders and can help you choose the right machine for your purpose.**
- **Our spare parts and accessories division is the largest and most modern in Australia.**
- **Trade-ins accepted.**
- **We hire tape recorders**

Magnetic Sound INDUSTRIES

387 George St. (2 doors from Kodak) BX4440, BX4587
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tent of 28 per cent., nine-tenths of which is held in a combination of urea and crotonaldehyde. This combination "doses" the release of nitrogen to the soil according to the temperature: when it is warm and the rapid growth of the grass calls for more nitrogen, the process works quickly—when the temperature drops, it is retarded.

[BASF, Ludwigshafen/Rh., West Germany.

TEMPERATURE CHECK

ONE of a number of developments in America aimed at reducing spoilage of frozen foods during transport or storage is a remote-registering alarm that shows when the temperature of the food is rising to thawing point.

The alarm is a small wireless broadcasting until the size of a retail package of food It is placed in a case with other packages with a temperature probe inserted into the food in a neighbouring package. The radio then broadcasts a regular report of the temperature in the package, which is received and recorded on a device in the warehouse office.

[Richard H. Eisken, Walnut Creek, California, U.S.A.]

FIRE-RETARDANT PAINT

A UNIQUE paint has fire-retardant qualities of Class I in the British Standard 476. The result of research spread over 2½ years it is called Oxylene P.V.A. Intumescent Fire Retardant Paint.

The uniqueness of this paint lies in the fact that it is a true paint, is ready for use in one tin, can be produced in the 100 or so colours of B.S. 2660, and, above all, is intumescent. That is to say, it swells on application and so produces a thick cellular blanket over the surface painted on, whether timber, plywood, acoustic tile or anything else.

This insulating film prevents oxygen getting to the wood surface and so holds up combustion.

The paint is a copolymer of polyvinyl acetate (P.V.A.) resins and is similar in general structure to emulsion paints, though modified to produce the fire-retardant properties. It is decorative and durable and can be applied by brush roller or spray. It can be washed and is resistant to abrasion.

[Timber Fire-Proofing Co., 13a Old Burlington Street, London, W.1., England.]

FLYING SCOOTER

A NEW British rotary wing aircraft, specially designed for crop spraying will halve the cost of the job, its manufacturers claim. The machine is so small and elementary in design—consisting of 'little more than metal tubing, pilot's seat, engine and crop-spraying tank," a makers' spokesman said—that it has been dubbed a "flying scooter."

The aircraft is a gyroplane, a machine which, unlike a helicopter, has a freely rotating rather than motor-driven rotor in flight, though the engine gives it a brief spin for take-off. This goes back to the principle of the prewar "autogiro," but was based on the American Bensen gyrocopter, of which the new gyroplane is a considerable modification.

Forward propulsion is given by a 1,639 c.c. two-stroke engine driving a pusher airscrew between the tubular metal beams at the back, and minimum speed is about 20 miles an hour a few inches over the top of the crop. A variety of crop-spraying booms can be fitted.

[D. Napier and Son Ltd., 211 The Vale, London, W.3, England.]

SCOOTER DOES 227 m.p.g.

A MOTOR scooter claimed to have a fuel consumption of 227 miles to the gallon is now being produced in Japan by an aircraft engine manufacturer.

It has a 90 c.c. air-cooled two-stroke engine which is said to develop 6.5 b.h.p. and is stated to have a top speed of 53 m.p.h. Called the Pointer-Lassie it is to be supplied complete with a self-starting system, up-to-date lighting and kit of tools.

[Shin Meiwa Industry Co. Ltd., Osaka, Japan.]

INTER-COMMUNICATION SYSTEM

A NEW British inter-communication system has been introduced to give emergency aid and the security of constant contact by a resident warden to elderly people living alone on social welfare and similar estates. But the manufacturers claim it is likely to be useful in other situations where expensive cable routes must be avoided.

The Portaphone system, as it is called, operates without inter-connecting cables and merely plugs into an electric mains socket. The power cable acts as a speech line, the mains voltage and alternating current "hum" being isolated from the equipment by a system of filters and capacitors.

Merely by pushing a button at either end residents may call the warden or vice- versa. Old-fashioned calling bell systems are eliminated.

The single loudspeaker of the Portaphone also acts as a microphone. On a suitable circuit an unlimited number of Portaphone may be used up to a distance of half a mile.

[Labgear Limited (Pye Group), Cambridge, England.]

ON THE BALL

TYPE bars and moving carriages are eliminated in the latest American electric typewriter, which is said to be quieter and to permit quick changes of type face.

The characters to be typed, instead of being on the end of long type bars, are in raised form on the surface of a nickel plated ball about the size of a walnut. The paper remains stationary in the machine—the ball moves along in front of it from left to right. In the printing position the ball is rotated in two axes to present the proper character to the paper and is then pressed against the paper.

Type faces can be changed by replacing one ball with another. The typewriter also has a built-in "memory" so if two keys are struck too close together, the second key impulse is stored for a fraction of a second until the first character has been printed.

Another feature of the machine is the method of changing ribbons. A container enclosing a new ribbon is just inserted in the machine and the ribbon threads itself automatically.

[International Business Machines Corp., Electric Typewriter Div., 545 Madison Avenue, New York 22, N.Y., U.S.A.]

ADCOLA

SOLDERING INSTRUMENTS

SAFETY APPROVED IN ALL STATES

NO TRANSFORMER REQUIRED

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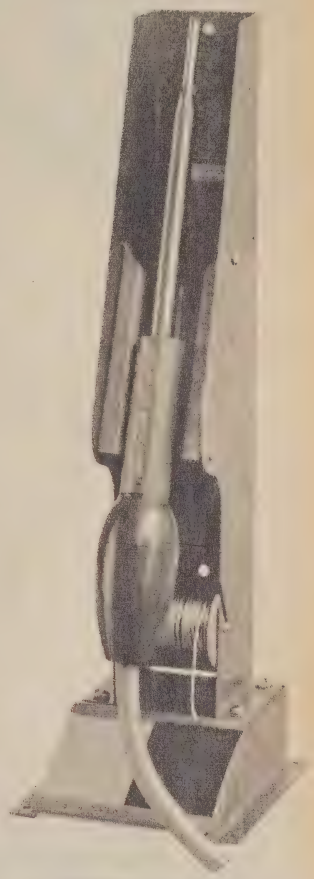

ILLUSTRATED **L64** *3/16' Bit Model operating in Protective Shield —* Complete with accessories—L700

Constant temperature performance for sound and durable joints.

Specialised tools for Radio and Electronics Equipment.

FURTHER INFORMATION FROM

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ELECTRONIC ORGANS

In forthcoming issues, we plan to present a series of articles covering the construction of practical electronic organs and items relevant thereto. This first article is intended to clear the way by discussing such questions as—What is an electronic organ? Is the term "organ" justified? How do typical instruments work? What principles are suitable or otherwise for home construction? Some of these questions are highly controversial but we do our best to answer them objectively.

By Neville Williams

Announced only this month, for release on the Australian market is this Schober Consolette organ, a smaller but very eloquent "brother" of the Schober Concert Organ. The upper manual provides three 16', four 8' and three 4' tones, while the lower manual has one 16', four 8' and two 4'. Pedals provide three 16' and one 8'. Two types of vibrato are available, while a selection of percussion effects is an optional extra. The organ is to be sold complete or as a build-it-yourself kit (The Electronic Organ Co. (Australia), 11 Cadow St., Pymble, N.S.W.)

THE subject of electronic organs is one in which there is currently a tremendous amount of interest — something which has been building continuously for some time.

In fact, reader interest in the subject dates back over 20 years, when a small group of local enthusiasts, working together, evolved their own versions of the then new Hammond organ. The resulting publicity in the Press and over radio stations fired the imagination of many others, whose interests included both electronics and music.

Some of these, deterred by the mechanical complexities of the Hammond tone wheel system turned instead to the realm of oscillators, multipliers, dividers, etc. and produced their own variously successful, fully electronic instruments.

To judge by casual conversation, a substantial proportion of all "radio" enthusiasts have, at one time or another, felt this urge to build such an instrument for themselves. And, to judge by our mail, every one of them has written to tell us about it!

One of several models, this is the Concert Hammond, which derives its tones from rotating tone wheels, using additive mixing to build the desired harmonic structure. Late model Hammonds have been developed far beyond their earlier prototypes, featuring variable "attack", pedal sustain, pedal solo facilities, percussion, reverberation and pre-set tone color keys, as well as the traditional drawbar mixing system. (W. H. Paling Pty. Ltd., 339 George St., Sydney.)

Fortunately, we are fairly well placed right now to talk about organs. Of our present not-over-large staff, two members have electronic organs substantially finished and operating, while a third has a complete acoustic pipe organ erected in his bedroom!

On the commercial front, the early trickle of developmental instruments has gradually built into a flood and electronic organs are already big business overseas.

A recent report from America indicates that organs are outselling pianos for the first time. The market in England is also building rapidly, with an estimated 50 per cent of the total output going to churches, 5 per cent to theatres and other entertainment centres, the rest being divided between private home use and export.

In England, a typical small organ for use in homes or small churches sells for £195 sterling, while an elaborate three-manual and pedal instrument might run to £1,500. However, this latter figure has to be compared with £10,000 for a large pipe organ, requiring additional substantial outlay for regular tuning and maintenance.

In Australia, the market for electronic organs is also on the increase. A large proportion of present sales is to churches, dissatisfied with reed instruments but, equally, unable to afford an acoustic pipe installation. Electronic organs are also being used quite freely for entertainment, while it is certain that a market exists for home use, at least for those instruments which can sell competitively with the traditional upright piano.

So much for the marketing aspect.

As distinct from anything that might be said in dictionaries, musical or otherwise, the term "organ" by common usage, has acquired a very wide range of meaning. Whether one agrees with such usage is another matter.

Traditionally, the term belongs to a race of keyboard/pipe instruments, intended primarily for use in churches but varying enormously in facilities, workmanship and ultimate performance. In

general, however, they are large, expensive, highly individual units.

Smaller churches, unable to afford pipe instruments, have long had to make do with keyboard/reed substitutes, often rather pathetic as musical instruments go, but still rejoicing locally under the title of "organ."

But the tale does not, by any means, finish there. In the heydey of silent pictures and the giant picture palaces, it was necessary to provide a musical background to the show, and the more grandiose it could be, the better the audience liked it.

Treading the footsteps of Hope-Jones, the Wurlitzer Company, along with others, developed a variety of "orchestral unit" instruments, played from a single complex console. The bulk of the sound was produced by pipes, often specially designed for the purpose, but it was conventional to add a variety of percussion devices and sound effects, even to a full grand piano, all controllable from the console.

But, because of the pipes and the keyboard, the inevitable happened and a whole generation learned to associate the term "organ" as much with movie houses as with churches. The name of the "organist" was invariably featured on the billboards.

But times have changed again since then and the Wurlitzers and Christies have progressively been stripped of their "orchestral" trappings and moved into churches or squeezed into the private homes of popular organ enthusiasts — having been sold for a mere fraction of their original cost.

Meanwhile, however, the upsurge of

This Australian - made Stromberg Carlson organ is priced at a figure which makes it an attractive proposition for the home or for medium - size churches. Oscillators serving the manual provide basic 8' tones but an extensive formant filter system provides a wide variety of tone colors, selectable by means of special potentiometers. Pedals are 16' equivalents. Provision is made for higher powered or extra amplifiers, for extension speakers and for earphone listening. (Stromberg-Carlson (A'sia) Pty. Ltd., 118 Bourke Rd., Alexandria, N.S.W.)

of their use in churches, or elsewhere, for the performance of classical organ works.

Others, again, have leaned more to the duplication of characteristics exhibited by the aforementionad Wurlitzer and Christie "orchestral units," with the major objective of playing popular music in the established style.

Still others have been content to produce an electronic keyboard instrument having as great a versatility as possible for the allowable production cost. They have accepted and exploited any "new sound" which thus became available, while similarly taking advantage of whatever degree the instruments could be played like church or theatre organs.

But, notwithstanding the motives of the designer and/or the degree of success achieved in the final instrument, they have all been lumped in modern terminology under the same title of electronic ORGAN.

As if that were not confusion enough, the past couple of years have seen the release, in large numbers, of electric "organs" which are little more than the works of an accordeon mounted in console style and provided with an inbuilt electric blower to activate the reeds.

In some cases they are equipped with

Distributed by Suttons Pty. Ltd. (42 York St., Sydney) this Wurlitzer model, one of several, packs a wide range of facilities, involving 39 control functions, two speakers and a 26W. amplifier into one compact console.

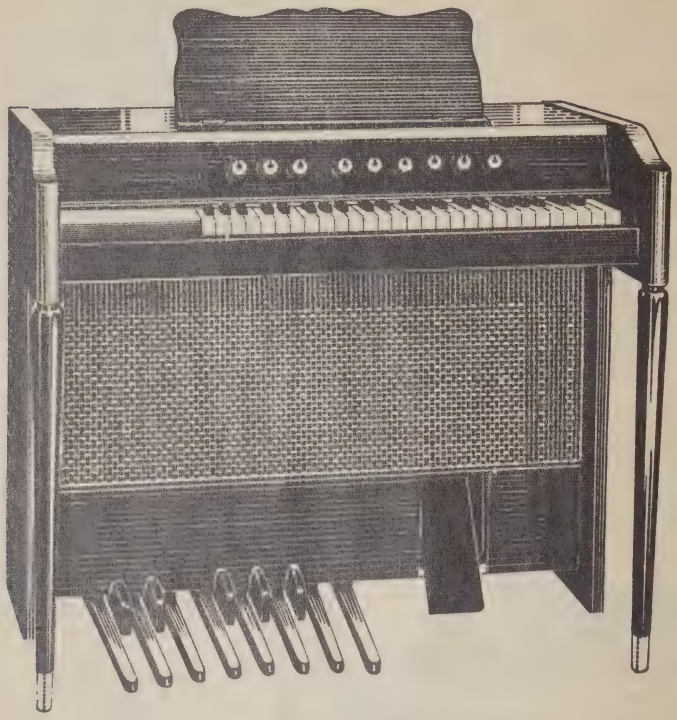
electronics has challenged engineers to produce keyboard-type musical instruments, using relatively compact tone-generating systems of one kind or another, but relying on switching systems, filters, amplifiers and loudspeakers to modify the sound and build it to the necessary proportions.

Here a great deal of further confusion and argument has arisen.

Some have sought, with varying degrees of success, to duplicate the facilities and tone colours of traditional church pipe organs, thinking primarily

Forty valves are involved in the circuitry of this Kinsman "Duchess" organ. The solo keyboard has 16', 8' & 4' tones, accompaniment 8' and pedals 16' & 8'. Also vibrato, sustain, percussion. (W. H. Paling Pty. Ltd.)

Explore the wonderful world of music with a Stromberg-Carlson



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ELECTRONIC ORGAN

Enquiries to Stromberg-Carlson Distributors Ltd., 120 Bourke Road, Alexandria, N.S.W.

inbuilt microphones to facilitate connection to an external amplifier.

As might be expected of an electronics magazine, we are concerned primarily with electronic organs, using the term in its present-day sense.

We described these earlier as "keyboard-type instruments using relatively compact tone-generating systems of one kind or another, but relying on switching systems, filters, amplifiers and loudspeakers to modify the sound and build it to the necessary proportions."

It may be possible to invent a better definition, but that will probably convey well enough what we have in mind. Let's expand the subject a little further.

REED SYSTEM

One general class of electronic organ uses specially suitable but otherwise normal REEDS as the initial tone source, their mechanical vibration being converted to electric signal voltages by an electrostatic or electromagnetic pick-up system. The exact nature of the reed and pickup system can be manipulated to determine the nature of the electrical signals in respect to harmonic content, etc., further manipulation being available within the amplifier and loudspeaker system.

In some cases (e.g., Everett) the reeds are individually activated by depressing the playing keys, using a more or less conventional pneumatic system. In others (notably certain Wurlitzer models) the reeds vibrate continuously, derived electrical signals being selected by the playing key action and stop settings prior to amplification.

In its most refined form, the principle is capable of extremely good results, many contending, with good reason, that reed generators give the closest approach yet achieved to pipe organ tone colours. However, the principle has commonly been a source of disappointment to enthusiasts who have seen in it — quite mistakenly — the "easy" way of producing an electronic organ.

From the homebuilder's point of view, problems typically encountered include the following:

- Poor mechanical qualities of reed instruments often selected for adaptation.
- Difficulty of producing a really quiet blower system.
- Difficulty of preventing acoustic output from the reeds from dominating the total sound, at least at the levels required in a home.
- Hum injection, due to the large-area, high-impedance pickup system and the low signal levels involved.
- Disappointing "tone" resulting partly from over-blowing the reeds and limited wave-shaping facilities.
- Excessive "beats" due to incorrect initial tuning or to drift with unsuitable reeds.

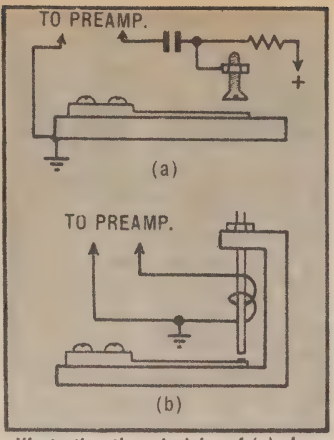
MICROPHONE PICKUP

Microphone pickup from reed instruments has also been the subject of some experiment, generally with indifferent success. It can provide a useful increase in volume and some improvement in "tone," as heard in churches and halls but the end result is always limited by the often-dubious characteristics of the original instrument and by the difficulty of getting anything like even pickup from the variously placed reed banks.

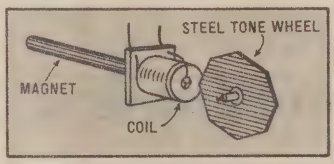
Another and more popular class of instrument generates the basic electrical signals for each note with tiny ALTERNATORS formed by toothed wheels rotating close to magnets. In the Hammond organ, the best-known example of this general class, the note and stop system allows the player to vary the harmonic structure of the sounds so produced through an extremely wide range, while swell, percussion, reverberation and tremulant effects are achieved in the amplifier system.

Various other rotating tone generator systems have been devised, even to glass discs carrying tracks recorded optically from an actual pipe organ.

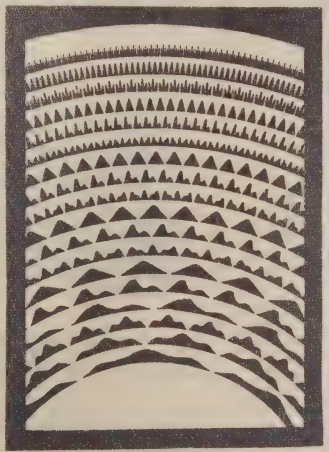
In fact, a survey of the literature on electronic organs leads one almost to the belief that every conceivable approach to the design of rotating tone generators has been investigated by some one at some time, in the hope that it would turn out to be the answer to a musician's prayer!



Illustrating the principles of (a) electrostatic pickup from reeds and (b) magnetic pickup, the latter less frequently used. The polarising voltage in (a) is usually about 300, the load resistor typically 2 megohms, while one preamplifier usually serves logical groups of pickup screws, wired together.



Hammond organs use tone wheels designed to produce sine waves, which are then subsequently added in desired proportions. Some designers have attempted to use generators with rotor and/or stator outlines designed to produce envelope shapes directly simulating desired organ tones.



Segment of a tone pattern disc intended for optical scanning and producing a variety of waveshapes for subsequent selection and mixing. Similar patterns in metal, on the surface of a non-transparent disc, have been used to induce signal voltages in an electrostatic pickup system.

PRECISION ESSENTIAL

The success of the Hammond organ is a matter of history but it is due in no small measure to the precision and compactness of their generator system, which readily can be enclosed and rendered virtually silent in operation.

However, many would-be builders of such mechano-electrical instruments, both commercial and amateur, have underestimated the degree of refinement necessary for good results. They have learned the hard way that rotating systems, scaled up to "workshop" dimensions, also make a "workshop" amount of noise, rendering them quite unsuitable in many cases for mounting directly in the console.

Apart from semi-acoustic or semi-mechanical instruments, many are fully electronic, in that the basic tone signals

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GE 2E/IIIA	3 channel	1xE88CC 1xE180F	40 db	6 db	1.2V	72/300Ω
GE 1B/III	channel 5-11	1xE88CC	17 db	7 db	0.7V	72/300Ω
GE 2B/III	channel 5-11	2xE88CC	30 db	7 db	0.7V	72/300Ω

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are generated by OSCILLATORS of one type or another, selected and combined by key action, stop controls and filters, then passed through amplifiers and loudspeakers.

The basic oscillator circuits typically use:

(1) Neon or other gas discharge devices which, while having the initial advantage of cheapness, present difficult though not insurmountable problems with stability.

(2) Valves, which dominate current practice. In large numbers, however, valves are costly, impose considerable load on the power supply equipment and generate considerable heat.

(3) Transistors, gaining considerably in popularity because of their small size and low power requirements. They require new circuit techniques, however, which take time to develop and to prove in practice.

In terms of general design, two distinct approaches are currently being exploited in practical instruments, each having advantages and disadvantages and relating to the overall design concept.

One approach is to provide a separate oscillator for each individual note (or should we say pitch) to be reproduced, the signals therefrom being selected, controlled in amplitude and filtered for waveshape, by normal operation of the playing keys and stop tabs.

The most complex organs of this type use one set of oscillators and waveshaping circuits for each major tone colour or organ "voice" provided on the console. The banks of oscillators are mounted in racks external to the console, much like so many ranks of pipes.

And, like ranks of pipes, they can be

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added at will, to the limits of space, money and commonsense!

Simpler organs, representing the vast majority of current designs, make do with a single set of oscillator circuitry per note, allowing, as a rule, everything to be concentrated in the console. Still further economy can be achieved by using one oscillator per pair or trio of adjacent notes, on the supposition that adjacent playing keys seldom require to be used together.

A second major approach involves the provision of 12 basic oscillators representing, generally, the top octave on the keyboard. With these are associated 12 sets of frequency dividing stages, which step the pitch down an octave at a time to provide the full range of frequencies called for by the keyboard(s) and possibly the pedal clavier.

As with the case of separate oscillators, some divider systems are more complex and comprehensive than others, but, in general, divider systems have been exploited as a means of simplifying total circuitry rather than the reverse.

One well-known organ, for example, uses valve-type master oscillators with neon tube-type frequency dividers.

IMPORTANT IMPLICATIONS

The use of separate oscillators or divider systems has implications over and above the mere bulk of circuitry involved.

With divider systems, the tuning and stability of the organ is bound up basically with 12 master oscillators. Periodic tuning involves setting up one octave only, all other octaves locking automatically to it. And, as far as stability is concerned, if this can be built into the basic oscillators it is virtually achieved for the organ as a whole.

Against this, however, it is frequently argued that divider systems are too precise in the relationship of one octave to the next, causing the instrument to sound too obviously an "electronic" device. In those instruments where each note is separately generated, the slight but inevitable wander in frequency and phase is claimed to add "interest" to the total sound and to simulate more closely what occurs in an acoustic organ.

While there is undoubtedly merit in both points of view, the question cannot be divorced from circumstances and personalities—a remark which is true of many aspects of organ design. If circumstances make it easier to follow one principle or the other, then there is good reason to do so, unless the constructor in question has a strong personal bias by reason of musical background, or the lack of it!

However, before getting too deeply involved in musical "aesthetics" it may be helpful to diverge briefly and to explain some of the terminology which must inevitably be introduced.

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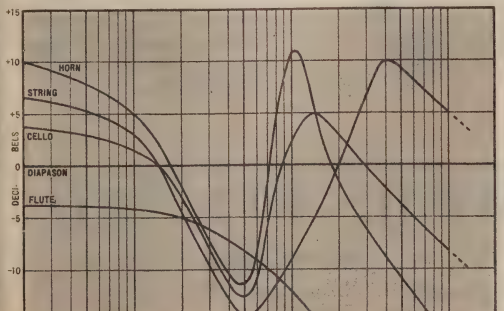

Frequency response curves for a typical set of formant filters. The curves serve only to illustrate the point in the accompanying text. They might have to be varied considerably in individual instruments to allow for variations in the harmonic structure of signal fed to the filters.

A pipe organ will normally sound the frequency to be expected from the position of a given playing key in the manual, when pipes are in use described by the term "eight-foot" (more simply 8'). Thus, using a rank of 8' pipes, depressing middle C would sound a frequency in the region of 262 cps, depending on the exact pitch of the instrument.

Using a 4' rank of pipes, depressing middle C would produce a frequency of about 524 cps, while a 2' rank would produce 1048 approx. cps. Contrariwise, a 16' rank, played at middle C, would sound an octave lower, at 131 cps. With all ranks speaking simultaneously, four distinct notes would be produced, at octave intervals.

In complex instruments it is not unusual to provide pipes speaking at musical intervals other than simple octaves, these being described by fractional footage terms.

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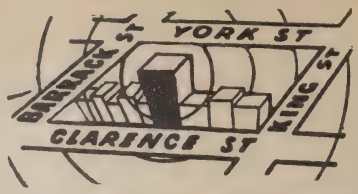

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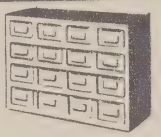

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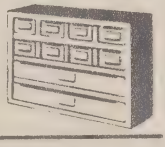

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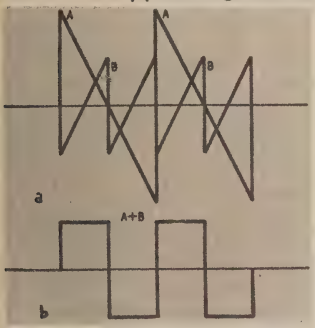
several harmonically related notes simultaneously from the one playing key, is explanation, in part, of the complex tones which can be built up on the instrument. Often the facility is increased further by the provision of mechanical, pneumatic or electrical couplings, which couple the playing key actually depressed to its counterpart in an adjacent octave or in another manual.

In addition to the simple multiplication of pitch, it is conventional to provide pipes which are "voiced" to produce tones having distinctive qualities, by reason of their differing overtone structure, attack, etc.

The ranks of pipes having these distinctive qualities are commonly selected by "stops" or "tabs" having individual and rather traditional names. Some of the names, notably "Diapason," belong only to the organ and describe what the organ builder intends as his basic organ tone. Others, like "Flute," "Oboe," "Horn" are broadly imitative of the orchestral instrument by the same name, though the resemblance is often more imaginary than real.



This piece of electronic "trickery" was used in the Baldwin organ. By suitably manipulating the phase and amplitude of 8' and 4' tones, even harmonics are phased out to produce a rectangular wave, which becomes the basis of "hollow" sounding woodwind tones.

CARRIED ON

Many of these terms have been carried, along with the name "organ" into reed and electronic instruments. Thus 8' simply means that the stop or tab in question selects a tone that will be heard at the frequency to be expected from the position of the playing key in the manual. Likewise 16', 4' and 2' indicate that the note heard will be respectively an octave below, an octave above or two octaves above the basic 8' pitch.

Similarly, the use of terms "Diapason," "Flute," "Oboe," &c., indicate that the tones are broadly equivalent to the same tones encountered in pipe organ practice. As such, they will be of greatest assistance to players who have a traditional organ background.

Two other terms occur frequently in discussion of electronic organs, namely "Vibrato" and "Tremulant." Both have to do with the slightly wavering quality which is often associated with organ music and which was exploited, along with other effects, in the "Orchestral Unit" instruments referred to earlier. But whereas the effects had to be obtained by rather cumbersome methods in acoustic instruments, they can be achieved much more easily, where electronics is involved.

"Vibrato" is an actual variation in pitch at a few cycles per second. "Tremulant," which is generally regarded as a less effective entertainment gimmick, is a variation in amplitude. In fact, the dividing line between the two is not always as clear as might appear and the terms are often used interchangeably and even confused with the "Vox Humana" effect in reed organs.

Several basic methods can be used in electronic organs to constitute or simulate particular musical tones.

ADDITIVE SYSTEM

In the "additive" method, the basic oscillators are arranged to give substantially sinoidal output. The outputs are then made available to the stop or tab system, so that depressing a particular playing key not only sounds the basic frequency appropriate to that key, but also a selection of other sinoidal signals harmonically or musically related to the basic frequency.

In other words, frequency multiples are added to the basic frequency until an effective overtone structure is built up appropriate to the desired tone colour.

While this system is employed very successfully in the Hammond organ, it tends to be cumbersome in fully electronic instruments by reason of the large number of separate oscillators which are required to provide the requisite number of frequencies.

The additive system produces, by nature, a uniformity of tone colour over the whole manual. While this may be desirable for some purposes, it tends to be unreal for other purely imitative stops, because the harmonic structure from the original acoustic instruments is itself not uniform over the range of notes they produce.

The opposite approach is to provide highly angular waveforms from the basic oscillators which, in general, contain all the harmonics of the basic repetition frequency likely to be required.

The stop or tab system then introduces a variety of so-called "formant" filters intended to favour signal voltages within a certain restricted band of frequencies. These pass harmonics falling within the selected band but attenuate progressively those outside it.

In justification of this system, it is claimed that many musical instruments, whose tone it may be desired to imitate, themselves tend to act as acoustic filters, accentuating or attenuating harmonics in different portions of the spectrum.

COMPLEX CIRCUITRY

Carried to its limit, the subtractive principal can likewise become very cumbersome because nearly pure tones, like that of the "Flute" would require the use of multiple highly selective filters, each operative on a relatively small section of the keyboard.

A still further approach, and one which tends to multiply circuitry in an alarming fashion, is to simulate the required tone structures by manipulating and selecting suitable waveforms from each individual oscillator unit. Obviously enough, each new major variation in waveform is likely to necessitate a complete new bank of wave-shaping circuitry.

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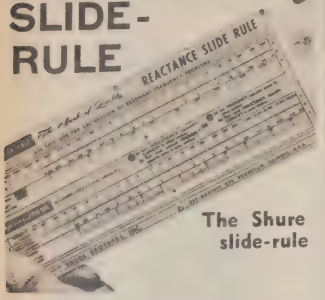
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or all methods which can contribute most conveniently to the end result. Thus, at different points in the one oscillator circuit, it may be possible to derive signal voltages which are substantially pure, or moderately coloured by harmonics; or highly coloured.

TWO SIGNALS

The nearly pure tones may well serve, as they are, for the "Flute" stop. The other signals, passed through simplified filters may be close enough to other desired tone colours to serve the purpose.

Further variation — and this becomes part of the playing technique — may be had from selecting different footages, and/or playing an octave above or below what is indicated on the music, to take advantage of the somewhat different tone colours so obtained.

Ideas are legion on how these tone colours should be selected. Hammond use drawbars, supplemented by pre-set tone switches, which look like distinctively coloured playing keys. Some organs use "tongue-tab" switches, others "rocker" type switches and still others, rotary potentiometers.

Here there is a clear conflict of space, position, tradition, utility, cost, etc., and the simple urge to make it look impressive, whether or not the instrument deserves such treatment.

The detail and function of the playing keys is another major consideration for electronic organ enthusiasts.

Switch contacts, themselves, can be the source of considerable difficulty and, obviously enough, systems calling for complex switching functions, multiply such difficulties roughly in proportion to the number of contacts to be made and broken.

One school of thought has favoured contacts of the type used in telephone key switches. These have the reputation of being rugged and reliable and are readily arranged into multi-contact stacks. However, they tend to impose a stiff action on the playing key and necessitate a suitable fingering technique.

To overcome this latter difficulty, multi-contact relays have been used, actuated by a single contact under each playing key. Though a high order of reliability has been achieved by this method, acoustic noise from the relays can become a problem.

The favoured technique at present is to use contact systems involving fingers of thin, springy wire, pressed at right angles against fixed "busbars" of the same material. The low mass of the contact and its high degree of flexibility minimises noise problems, ensures a light "touch" characteristic and gives a degree of tolerance as to how the keys are depressed.

TROUBLES MINIMISED

By choosing a wire with non-tarnishing surface and arranging the system so that a slight amount of "wipe" takes place as the key is depressed, contact troubles are minimised.

What purpose the contacts serve, of course, is also important and relevant to the discussion.

One basic technique is to have the tone generating sources operating continuously, using the key-operated switches to feed the signal therefrom to the amplifier. Since the contact is directly in the signal circuit, freedom from noisy contact is a prime requirement; also sharp

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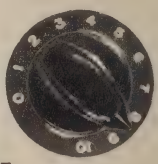

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"attack" and sharp "decay" can be a problem, since the contacts simply make and break a permanently active signal circuit.

An alternative is to have the key contact start the oscillator, by switching a grid bias or some such function. By this technique, the contact is one step removed from the signal circuit, while the slight "inertia" of the oscillatory circuit secures a tapered attack and decay characteristic. This is particularly true of inductive circuits.

There is a good deal more to all this than many would-be organ builders seem to realise. The tendency, in many cases, is to attack the tone generating circuits first and to regard the manual(s) and console as annoying details of carpentry that can be worried about later. In fact, where an organ has to be built "from the ground up," it is not a bad plan to reverse the whole approach, planning the electronics only so far as to clarify general requirements, then concentrating the initial effort on mounting the keyboards and installing and testing the contact system.

How many amplifiers one should use, what power rating, how many speakers and how baffled are all additional and important questions but they are on ground which will be more familiar to most of our readers.

VARIOUS APPROACHES

Perhaps one can round all this off by saying that the scope of electronic organs is virtually unlimited.

They can be built along strictly traditional organ lines, with tone colours so close to pipe instruments that, given the right environment, it would be very difficult to pick one from the other. But this order of simulation would call for a degree of cost and complexity exceeded only by the pipe installation which it would replace.

Similarly, there is no special reason why an electronic organ could not have all the trappings and flamboyancies of a theatre "orchestral unit" and, in fact, the most elaborate versions do.

But the kind of electronic organ intended for home use, and selling for a few hundred pounds cannot rival either of these concepts. It may have a bias one way or the other, and a corresponding place on the market, but it is well to remember that small electronic organs have no real counterpart in the acoustic field.

They are essentially a new and distinctive keyboard instrument, capable of giving much pleasure in many applications, but they deserve to be exploited on their own merits, not accepted or condemned because they do or do not completely resemble instruments of another type.

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(Continued on Page 109)

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Over past months, we have received many questions regarding rotating electric machines —motors, generators, alternators, etc. Accordingly, we will attempt to answer many of the queries by explaining the fundamental operation of some of the machines regularly encountered. This month we deal with direct current machines and their operation, and next month with alternating current machines.

By JAMIESON ROWE

ALL commonly encountered rotating electric machines operate in accordance with one or both of two basic principles. One principle concerns the reaction between a conductor and any changes in the magetic field in which it finds itself, while the other concerns the reaction between a current-carrying conductor and a surrounding magnetic field external to its own.

The first principle is commonly called the "Generator Rule" or the "induced voltage" principle. It may be stated as:

"When the magnetic field around a conductor effectively alters in magnitude or direction (or both), an electromotive force (EMF) is induced or set up in the conductor. The EMF is dependent in magnitude and direction on the change in magnetic conditions producing it, and appears in such a way that any current produced by it in the conductor will result in a magnetic field tending to cancel the original change."

As the definition would imply, this principle is the basis for all generators and alternators. If a magnetic field and a conductor are changing with respect to one another, a voltage is induced in the conductor. In practice, it is usual to move the conductor and field relatively rather than vary the field amplitude (in rotary machines, at least), but the converse is occasionally done.

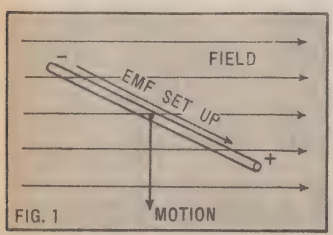

FIG. 1

How is the basic principle put into practice? A glance at figures 1 and 2 should help in understanding the principles of generator operation.

In figure 1 we see how a conductor moving in a stationary magnetic field develops an EMF across its ends. Note that the motion, the field, and the EMF are all mutually at right angles.

In figure 2(a) the sketch shows the development of this basic idea into a simple revolving-loop source of EMF. The loop of wire ABCD revolves about a central axis in the magnetic field produced by a permanent magnet. Induced EMF in the sections AB and CD of the loop add together in all positions, and the resulting voltage appears at the sliprings. Any voltages induced in the sections BC and AD are opposite and thus cancel, producing no net effect.

The voltage which appears at the sliprings reverses in polarity with each half revolution, due to the alternate upward and downward motion in the field by the sections AB and CD. If a centre-zero voltmeter is connected to the sliprings as shown, it will indicate the alternating nature of the voltage.

BASIC ALTERNATOR

This simple, but practical, device is thus the simplest alternating current generator or "alternator"; more will be said about it next month. For the present, we are more concerned with the problem of getting unidirectional output voltage from the simple rotating machine.

If the coil generates an alternating potential, how do we obtain a unidirectional output? One way would be to use rectifier diodes, of course, but this would often be unsuitable — especially when we can perform the rectification by means of a "synchronous switch" mounted on the actual machine.

To obtain a DC ouput from a rotating machine, this is what is usually done. Figure 2(b) shows how the synchronous reversing switch or "commutator" is used in place of the sliprings used in the previous case.

The commutator is arranged so that the external connections to the coil are reversed just as the coil voltage is reversing. Thus the terminal voltage is unidirectional, even though it varies in amplitude.

This machine is obviously a very simple and crude device, and would produce a very small output voltage and current. Practical machines have multi-turn coils instead of a single turn, which increases the efficiency by a considerable amount. To increase it still further, and reduce the output ripple, other coils are also added, inclined at various angles to the first.

The commutator is altered to provide two (opposite) segments per coil, and the brushes are supplied with a voltage which remains approximately constant. This is indicated on the diagram by a dotted line.

FIELD TYPES

To date, we have been considering machines which use a permanent magnet to supply the magnetic field. Machines of this type generally go by the name of "Magnetos," and are comparatively few in number. Probably the vast majority of all rotating machines have a non-permanent magnetic field, in which the field energy is provided by coils wound on the field structure and fed with exciting current.

The machine may be fed with exciting (field) current from an outside supply, when it is called "separately excited," or it may be arranged so that its own generated EMF produces the ex-

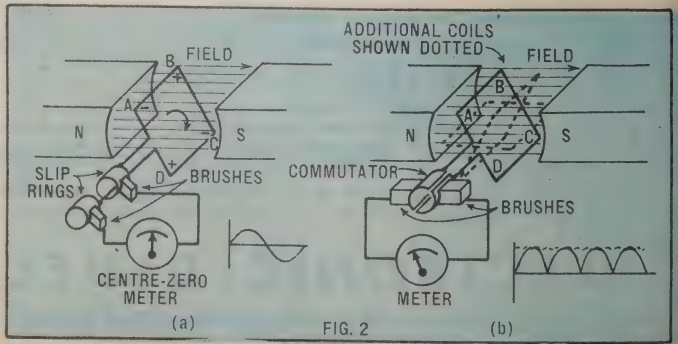

FIG. 2

citation (as well as supplying the output power—the field current is usually quite small). This type of machine is said to be "self-excited."

How does such a machine start, you might wonder, when it supplies its own field excitation? The answer is simple—all iron magnetic circuits retain a small amount of magnetism, even when the magnetising current in the exciting coils is removed. This retained field is called the "remanence," and in a self-excited generator the remanence provides the initial field magnetism to start the generation process. This produces a small EMF, which adds excitation to the remanence, etc., and the machine builds up to full operating voltage and output.

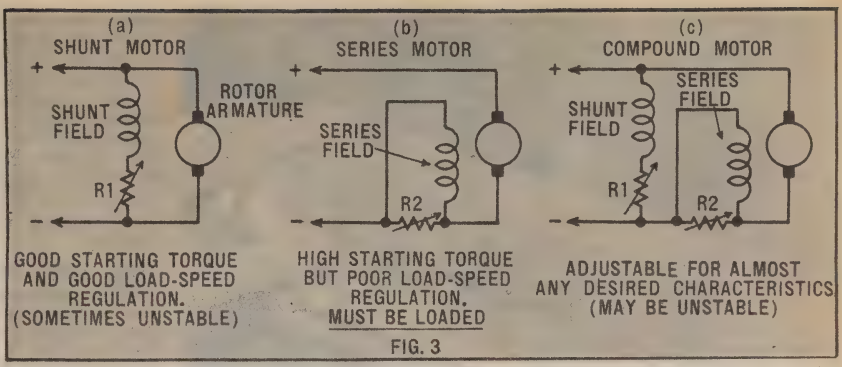

FIG. 3

NEW MACHINES

(Note: Newly assembled machines may require to be magnetised initially, since they would not normally have any remanence. Also, a machine which has been idle and disconnected for some time may fail to build up if the field is re-connected with the polarity reversed. This would mean that the small voltage produced by the remanence was causing excitation tending to cancel the remanence rather than add to it. The remedy would be to stop and reverse the field connections.)

The second principle involved in rotating electrical machine operation is usually called the "Motor Rule." It may be expressed as:

"A current carrying conductor in a magnetic field experiences a physical force, directed in a direction at right angles to both the current flow and the direction of the magnetic field, and having a magnitude proportional to the current flowing and the strength of the surrounding field."

This principle is responsible for the operation of most electrical motors, as it describes the process of converting electrical energy into mechanical energy. (More advanced readers will realise that the two "basic principles" which we have been discussing are really the same principle, seen from opposite viewpoints.)

How is the principle put into practice in the form of motors? In a way exactly corresponding to that of the generator principle — in fact, most generators may be used as motors.

SIMPLE MOTOR

Turn back to Figure 2 (a). Consider what would happen if we supplied the coil with an alternating potential via the sliprings. If the position of the coil and the phase of the applied potential had the correct relationship, the coil current would always result in a unidirectional torque being experienced by the coil. Thus the coil would receive torque as long as it rotated once every cycle of the applied AC.

Such a motor forms the basis of most AC synchronous motors, and we will discuss it more fully next month. Note in passing, however, that the synchronous motor is not self-starting, but must be brought externally to "synchronous speed" (that speed at which the rotor moves to keep its current in step with the field.) Once this speed is reached the motor will continue to run and provide mechanical power.

The simple DC motor, like its AC counterpart, may be constructed along the same lines as the generator. Thus the diagram of Figure 2 (b) may be used to explain the operation of an elementary DC motor. Instead of driving the coil around, imagine the brushes fed with direct current.

Since the brushes and commutator form a synchronous reversing switch which reverses the coil current for each half revolution, it is clear that the coil will receive a unidirectional torque due to the forces experienced by sections AB and CD. The coil will thus rotate, building up in speed until the load (or friction) reaches an equilibrium with the input power.

Thus the device forms a simple "permanent magnet field" DC motor. This machine would have a very low torque due to the simple rotor system, but may be greatly improved by increasing the number of coils and the turns on each, as in the generator case. Such simple permanent-magnet field DC motors find considerable use in low-voltage, low-power applications such as model trains, as they may be easily reversed—simply by reversing the supply voltage polarity.

As before, the permanent magnet field may be replaced by a set or sets of field windings, through which a DC excitation flows. If the field windings are fed from a separate supply, the machine is termed "separately excited." Any field windings fed from the same supply as the rotor

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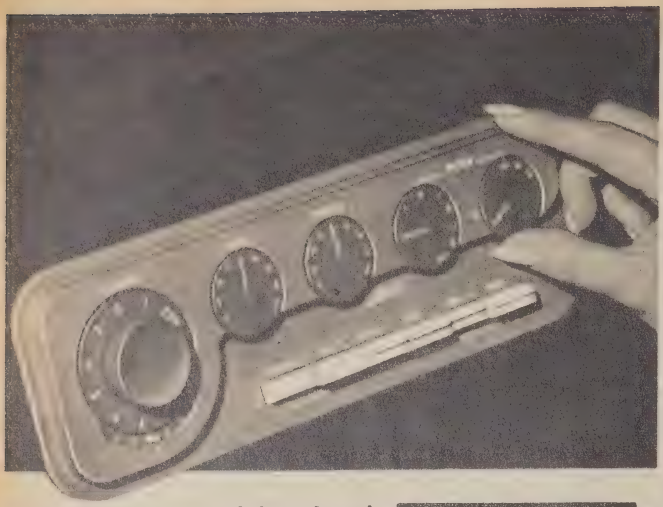

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The Quad 22 Control Unit incorporates every practical refinement for the full appreciation and enjoyment of the discriminating listener.

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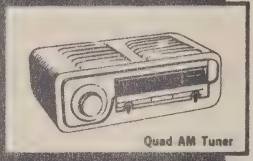
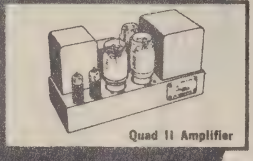
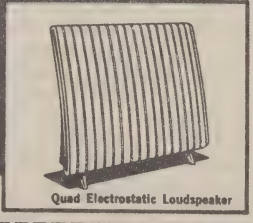
Quad 22 operates from radio, microphone, disc, tape, single track and stereo recordings. Matching is provided for any pick-up.

Quad 22 Control Unit


Quad AM Tuner


Quad II Amplifier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system (the usual method) are termed "series" or "shunt" fields, depending on the method of connection.

Figue 3 shows three common types of motor which differ in the type of field excitation used. Part (a) shows a motor with the field connected across the rotor supply, and called a SHUNT MOTOR. Part (b) shows a motor with the field connected in series with the rotor circuit, and called a SERIES MOTOR. Part (c) shows a motor which has both series and shunt fields, called a COMPOUND MOTOR.

FIELD REGULATORS

The variable resistors R1 and R2 are used as field current regulators, to adjust the strength of the field. Note that the shunt field (a high resistance, low current winding) is adjusted by a series resistor, while the series field (a low resistance, high current winding) is adjusted by a shunt resistor. This is because in the series case the rotor current must remain unaltered by the field regulator —the shunt resistor R2 merely by-passes current from the series field.

What is performed by varying the field excitation? To answer this, recall what we learned from the first principle of rotating machines, namely that conductors moving in a magnetic field generate an EMF. The EMF is proportional to both the speed of rotation and the magnetic field.

In an electric motor, the rotating coils develop a generated voltage just like a generator, called the "back EMF." The polarity of this voltage is such that it tends to reduce the rotor current by cancelling the applied rotor voltage. In normal motor operation, the machine speeds up until its back EMF reduces the rotor current to a value just able to provide the load torque.

By varying the field excitation, the speed at which the back EMF allows the critical rotor current to flow is altered. Thus the field regulator is used simply as a speed control. To run the motor at low speeds, high field excitation is required, which is reduced with increasing speed.

As the diagrams show, the various types of motor exhibit different load-speed characteristics and starting torque values, which determines the type of motor for a certain job. The shunt motor has good starting torque and regulation, but may become unstable due to the magnetic saturation effects in the stator—speeding up under loading!

SERIES MOTOR

The series motor has a very high starting torque, but fails quickly with loading, being poorly regulated. It is often used for applications where high torque at low speeds is required (such as in traction system). Series motors must not be left unloaded, however, or they will quickly gather speed and may fly apart.

Probably most practical motors are of the compound type, which combines the features of the series and shunt types. By adjusting the series and shunt field regulators, almost any desired starting-torque and torque-speed characteristic may be obtained, including unstable settings similar to the shunt motor.

Well, Tom, that brings us to the end of this rather brief discussion of direct-current motors. Next month we will examine alternating current motors and their operation.

FROM THE SERVICEMAN WHO TELLS

HOW (NOT) TO REPAIR A SPEAKER

How thoroughly do you check a piece of equipment after you have found and corrected the customer's complaint? If you are tempted to duck-shove this important function when the pressure's on, think again. My main story this month is a typical example of how a serious fault can be completely overlooked by the owner—and the serviceman too, if he is not careful.

BUT, before I get on to the main story, take a look at the picture on this page. I need hardly tell my older readers that it represents just one more butchered speaker in a long line of these devices which I have collected over the years. I don't know how many possible ways there are to perform this rite, but we must surely have covered most of them by now.

In case you don't recognise it, the material adhering to the cone is masking tape as used by spray painters. It is made from a fairly heavy paper base and coated with a rather potent adhesive. Its effect on the speaker's performance was drastic, to say the least.

The story started when the customer pushed a popular four-valve mantel set over the counter, with the rather vague statement that ". . . it needs fixing." The only elaboration he offered was that it was completely dead and he ". . . thought it needed a new speaker cone." All of which sounded very much like a routine job, with a single component, such as a valve, needing to be replaced, plus a check on the speaker.

My first step was simply to plug it in, as was, and check results. It appeared to be completely dead, just as the owner had claimed, and I had no doubt I would find a major circuit fault. Whatever might be wrong with the speaker cone, I didn't imagine it would be the main fault.

SHOCK

Nevertheless, it was something of a shock when I slipped the chassis out of the cabinet and came face to face with the speaker. Some idea of what I saw can be gleaned from the photograph, but this is really only part of the story. Unfortunately, I had to complete the job before the picture could be taken, so it does not show the speaker "in situ."

As I found it, the strips of tape extended beyond the edge of the speaker on to the cardboard baffle against which it was mounted. In fact, the latter was just as liberally covered with tape as the cone of the speaker. Just what had prompted the owner to take such drastic action I cannot say, but he had certainly been most generous, once he started.

Fairly obviously, the speaker was a write-off. Since I had no direct replacement on hand, I immediately placed an order for one, reasoning that I could connect the bench speaker in place temporarily, while I investigated the other fault in the set.

As it turned out, the "other" fault proved to be a myth. Immediately I connected the bench speaker in circuit the set played normally and a routine check with the generator showed that it was normal in every way. On the face of it, I could only conclude that the speaker must have been at fault in other respects.

A check with the ohmmeter showed the voice coil as being intact, but the application of signal produced no sound. A more detailed examination showed why, the voice coil and cone assembly being virtually rigid and quite incapable of responding to the normal magnetic forces.

I am not quite sure how this came about. It may have been simply because the cone had been pulled badly off centre, but I am inclined to the idea that it had been either pushed hard in or pulled hard out by whoever applied the tape. In any case, the really surprising part, to me, was the degree of immobility involved.

WHY DID HE DO IT?

As to the exact reason for the tape in the first place, I'm afraid that remains something of a mystery. There was a small tear in the cone which may have caused some rattling, but I find it hard to believe that the owner would have been as fastidious as all that.

When he called to collect the set I told him I had found it necessary to fit a new speaker. His reply was a classic understatement. "Yeah, I thought y'might have to."

Strangely enough, there was little more that he could — or would — tell me about it, claiming that it must have been "one of the other blokes." I then learned that the set was a kind of communal unit belonging to a group of employees at a garage-cum-all-night-cab-wash establishment (thus explaining the masking tape) and that any one of the group could have been responsible.

But why? Well, your guess is as good as mine.

And now for my main story. It concerns a TV set and, as you may have gathered, the fault in question was not the one which prompted the service call in the first place. In fact, serious though it was, the owner appeared to be quite unaware that any such fault existed.

NO PICTURE

It all started when I answered a call at a customer's house and found a set with normal sound but no picture and no deflection. In itself, this wasn't a particularly difficult job to diagnose and, in fact, acting on the symptoms passed by the owner over the phone, I had come prepared. Sure enough, as I suspected, the horizontal output transformer was burnt out.

It was quite a straightforward job to fit a new one, and was one case where repairs in the customer's lounge room could be justified. If nothing else, it meant that the set would be back in operation that evening, always a good point in customer relations.

When the job was finished and the set running again I made a routine check of the various controls — linearity, fine tuning, etc. — and touched them up as required. And it was just as well I did because, when I tried the contrast control, there was no response of any kind.

What was more, when I asked the owner how long it had been like that, he blithely informed me that, as far as he could remember, it had never had any effect on the picture. From the rest of his remarks I gathered that he didn't

Another one for the record. The strips of material are lengths of heavy duty paper masking tape, though why they were applied in the first place is something of a mystery. They held the cone so firmly that the speaker refused to play.

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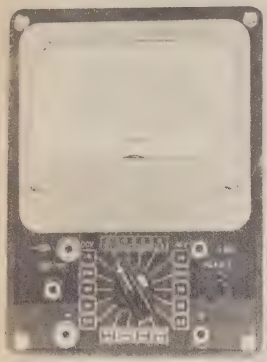


MODEL RH-955

MODEL RH-955

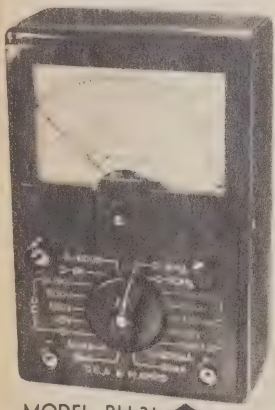
SPECIFICATIONS

* **Sensitivity:**
50,000 ohms per volt DC
5,000 ohms per volt AC
* **6 Ranges:**
DC voltage: 0-2.5-10-50-250-1000 volts.
AC voltage: 0-2.5-10-50-250-1000 volts.
DC current: 0-100uA, 0-10-100-500mA, 10 Amps. (all at 250mV)
Resistance:

Ranges	Centre scale
0-20,000 ohms	200 ohms
0-0.2 megs.	2,000 ohms
0-2 megs.	20,000 ohms
0-20 megs.	0.2 megs

Decibels: —20 + 46. db 5 ranges (0 db 1mW into 600 ohms)
* **Dimensions:** 7in x 5¼in x 3in.
With Plastic Pouch Test Lead Kit.
* **Meter sensitivity:** 20uA

PRICE £23/16/-
Including Sales Tax.



MODEL RH-31

MODEL RH-31

* 20,000 Ohms per Volt on DC
* 10,000 Ohms per Volt on AC
* 3½" Meter
* 18 position selector

SPECIFICATIONS

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AC Voltages: 0-5-25-100-500-1000V (10,000 Ohms/Volt)
DC Current: 0-50 uA, 0-5-50-500mA
Resistance: 0-6K-600K, 0-6Meg-60Meg (30 Ohms, 3K, 30K, 440K at centre scale)
Capacitance: 100uuF--0.01uF, 0.002uF-0.3uF
Inductance: 20 H to 2000 H
Decibels: minus 20db to plus 30db in 2 ranges
Output Jack: for Audio measurements
Dimensions: (3¾" x 5¾" x 2 3-8")
Weight: (23oz approx.)
Complete with internal battery and testing leads with prods.

PRICE £12/5/-
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Complete with earphone and mike combined. As Illustrated

SPECIFICATIONS

Portable tape recorder with speaker. Size 7in x 8in. 3in reel 200ft or L.P. 300ft recording time, speed 3¾, 10 minutes or 15 minutes, rewind 4 minutes.
Crystal Microphone.
Magnetic Earpiece.
2¼in Speaker.
2 tone plastic case and carrying strap.

PRICE — £19/19/-
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MODEL RH50

Modern Design. 33 Micro Amp Meter.
30,000 Ohms per Volt D.C.
13,000 Ohms per Volt A.C.
1 p.c. Multipliers and Shunts used.
Printed circuit.
Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 ohms per volt.
AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 ohms per volt.
DC Currents: 0.06-6-60-600 mA, 0-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: —20 to + 57 db (0 db = 1 mW, 600 ohms).
Audio Out: Capacitor in series with AC volt ranges.
Short Test: Internal buzzer.
Accessory: 1 pair heavy test leads.
Batteries: 1 (1.5V), 1 (15V).
Size: 3 5-16in x 6 5-16in x 2¼in.
Weight: 1.4lb approx.

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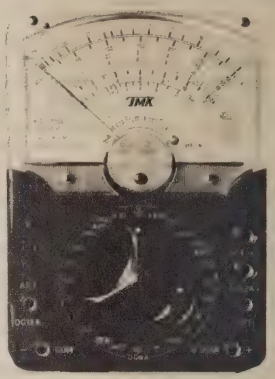


MODEL RH50

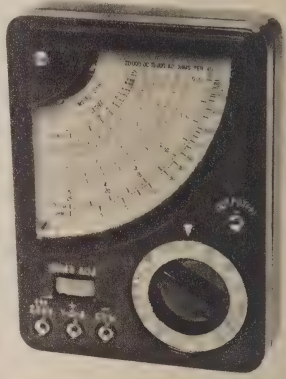
MODEL RH-200

20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS

DC Volt: 0-5, 0-25, 0-50, 0-250, 0-500, 0-2,500
AC Volt: 0-10, 0-50, 0-100, 0-500, 0-1,000
DC Current: 0-50, Microampe res, 0-25, 0-250 Milliamperes
Resistance: 0-60K Ohms, 0-6Meg Ohms
Capacity: 0.01-0.3mfd (at AC 5 Volt)
0.0001-0.01mfd (at AC 250 Volt)
Decibel: minus 20db plus 22db
Output Range: 0-10, 0-50, 0-100, 0-500, 0-1,000
Battery used: UM-3-1.5V, 1 piece
Dimensions: 3¼" x 4½" x 1 1-8"
Complete with internal battery, testing leads and prods.

PRICE £7/10/-
Including Sales Tax.



MODEL RH-200

THE LATEST IN RADIOS

Imported Radio and Cigarette lighter combination. Size 3in x 1¾in x ½in. Beautiful plastic case holds both, 2 trans and diode radio and flip type lighter Earphone switches Radio on when plugged in. Complete with internal Mercury battery, felt pouch and presentation case. Cigarette lighter lifts out for filling. The ideal gift for smokers. Postage extra. £7/9/6.

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know what it was for and was quite happy with the picture as it was anyway.

As far as the last point was concerned I had to agree that, quite by chance apparently, the contrast was reasonably correct as it was. To be sure, channel 2 was a trifle garish on some material, but I doubt whether anyone worried unduly about it. Presumably, they were perfectly happy to accept their contrast "as it came."

On the other hand, I could hardly ignore such a glaring fault, particularly as the owner's attention had now been drawn to it. Even though he professed not to care, it would be a fair bet that he eventually would change his mind and realise that he was being deprived of something to which he had a right. So, out came the chassis for the second time.

CONTRAST CONTROL

The contrast control in this receiver operated via the gated AGC system. Varying the contrast control varied the AGC voltage and, in turn, the strength of signal reaching the video amplifier. This much I knew from previous acquaintance with the circuit, but I had never before had occasion to study this part in detail. Now, it seemed, was the time for me to rectify this omission.

As it turned out, a few obvious clues led me to the trouble without my having to delve too deeply into basic theory. However, readers may find the story easier to follow if they are familiar with the circuit beforehand.

For the most part the AGC system was fairly conventional. A pentode amplifier (EF80) served as a gating valve, its plate connected to a tapping on the line output transformer via a capacitor in the usual way; the voltage developed across this capacitor served as the AGC voltage.

The screen connected directly to the HT line, while the grid connected to the moving arm of a 50K pot, which was the contrast control. One end of the pot went to chassis, the other end to a resistance network from the HT line which produced about 12 volts positive at this point.

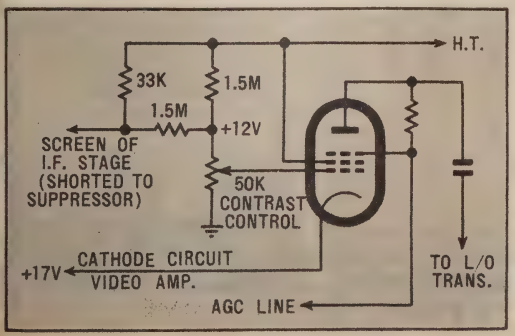
The cathode connected to a network in the cathode circuit of the video amplifier, such that it was held at about 17 volts positive and also fed with video signal, in particular the synchronising pulses.

Thus, with no positive voltage applied to the grid from the contrast control, there would be an effective negative bias of 17 volts, sufficient to cut off the plate current and prevent the generation of AGC voltage. Under these conditions the picture would have maximum contrast.

With a maximum of 12 volts positive applied to the grid, bias would be reduced to -5 volts. In addition, the synch pulse in the cathode circuit would subtract from the nominal 17 volts, so that the grid of AGC valve would vary from -5 volts, between pulses, to some lower figure during each pulse, depending on signal strength.

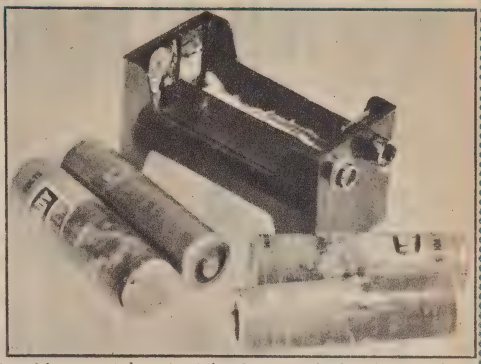
In these circumstances maximum AGC voltage would be developed and the picture would have minimum contrast. Intermediate settings would, of course, produce intermediate degrees of contrast.

So much then, for the theory of the circuit. As I said before, I had only a vague idea of these details when I turned



contrast control and AGC system. Failure of the IF stage screen also rendered the contrast control inoperative.

YES, THEY STILL FORGET THEM



YES, despite the number of times people are warned, they still leave discharged batteries in radio sets. This picture shows the battery compartment of a popular make transistor set, as it appeared when I opened it in the workshop a few days ago. As can be seen, the batteries were a soggy mess and the compartment and contacts liberally covered with white crystals.

In general terms, it was a common story. The set had been left turned on, apparently for several days, and the batteries completely "flattened." In the circumstances one can hardly blame them if they finished up with their inside outside.

In greater detail it appeared that the set had been dropped or otherwise abused, and, as a result of this, part of the case had been fractured. In the normal way this might not have mattered—except aesthetically—but it so happened that the section of the case involved carried a pair of earphone jacks.

These were wired in the output transformer/voice coil circuit in such a way that plugging in an earphone would silence the speaker. Unfortunately, the stress on the broken case had fractured an output transformer lead where it joined one of the jacks, thus rendering both the earphone and speaker circuits inoperative.

And, as so often happens in such cases, the owner had apparently turned the volume control flat out in a vain effort to make the set work, given up in disgust, and put it aside without bothering to return the control to the "off" position.

Since it was several days before he bothered to bring it into the shop, the batteries had well and truly "had it" by the time he did, with the result as shown.

Fortunately, most of the mess was confined to the battery compartment, and this was comparatively easy to clean up. But a tiny spot of corrosion on one corner of the printed board showed which way the mess was heading, and left little doubt as to what the result would have been had it been left for a few more days.

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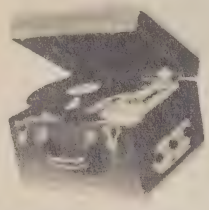

RECORD PLAYER AMPLIFIER

A most compact and lightweight unit combines a 4-watt amplifier with two inputs, one for the built-in 4-speed B.S.R. Record Player and one for a Crystal Microphone. Each Input has its own volume control and a tone control with on-off switch provided. Two outputs are also available. One operates through the built-in oval speaker and a jack is provided so that a suitable external speaker can be connected. The case is finished in attractive two-tone leatherette. Ideal for parties or playing records, etc., at home.

Well worth 35 gns. **Price only £19/10/-.**

Extension Speaker, 6in. in leatherette covered box. Worth £5. **Our price, 69/6.** Larger sizes also available.

Crystal Microphones to match this unit are available from **25/- upwards.**

Record Changers—Extra special sale of brand-new 4-speed record changers in original carton. Well-known make, complete ready for installation. Plays 7, 10 or 12in records. **Bargain price at £9/19/6.**

Stereo Record Changers. 4-speed. Will play any type of records, has crystal cartridge with two Sapphire styli. Brand new and boxed. Well-known English make. **Price only £11/19/6.**

WIZARD SIGNAL INJECTOR

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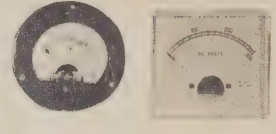

WIZARD METERS

Just landed. Panel Meters, all types, 2.5 per cent accurate. Two models available as follows:

MO 65. Round Black Bakelite case, overall diameter 3¾ inches.

MR 4P Rectangular Plastic Case, overall size, 4¾ x 4½.

Prices are as follows:

Type	MR 4P	MO 65
50 Micro-amp	£5 10 0	£4 13 0
100 Micro-amp	4 10 0	4 1 0
500 Micro-amp	3 15 0	3 0 0
1 Milliamp	3 10 0	2 2 0
5 Amps	3 10 0	2 2 0
15 Amps	3 10 0	2 2 0
30-0-30 Amps	3 15 0	2 5 0
20 Volts DC	3 10 0	2 2 0
100 volts DC	3 10 0	2 2 0
300 volts DC	3 10 0	2 2 0
20 Volts AC	3 10 0	—
50 volts AC	3 10 0	—
100 volts AC	3 10 0	—
300 volts AC	3 10 0	2 2 0
5 Amps AC	—	2 2 0

Note: All AC Voltmeters are of rectifier type. All prices plus 12½% sales tax. Special prices for quantity on application.

TECH MULTIMETER

Model PT34. Overall size 3¾ x 2 3/8 x 1¼in. Sensitivity of meter 1,000 ohms per volt. AC and DC current range 0-1mA, 100mA, 500mA. Resistance 0-100,000 ohms. An efficient meter at a cheap price. **Price, only 65/3.**

TMK MODEL TP10 MULTIMETER

A good cheaply priced meter for general work. Ideal for the home handyman, for work on radio, electrical, motor cars, etc. Fits easily into the pocket and has a rugged meter movement. Sensitivity is 2000 ohms per volt.

Specifications:

DC Voltages, 10, 50, 500, 1000 (2000 O.P.V.).

AC Voltages 10, 50, 500, 1000 (2000 O.P.V.).

DC Current, 500 micro-amps, 500mA.

Resistance: 0-10,000 ohms, 0-1 meg.

Capacitance: 0.0005 to 0.2 mfd.
0.005 to 1 mfd.

Decibels: minus 20db plus 36db in 2 ranges.

Output Jack for audio measurements.

Dimensions: 3½ x 5 x 1 9/16 inches.

Weight: 13oz.

Battery: 1 only 915 Eveready.

Price only **£5/12/6**, plus 12½% Sales Tax. **£6/6/7** plus freight.

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The following is a list of a large variety of Condensers of all types, Mica, Block Mica, Paper Block and Tubular Oil filled Block and Electrolytics. All are new and guaranteed to be in good order.

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.0003 mfd	600V.	Block paper	6d
.001 mfd.		Mica	1/-
.001 mfd	5000V.	Block Mica	5/-
.0025 mfd.		Mica	1/-
.005 mfd	2500V.	Block Paper	9d
.005 mfd	1750V.	Mica	2/-
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the chassis upside down on the customer's lounge room floor. I hoped, with the aid of the manufacturer's circuit and data, to find some obvious fault which would lead me to the trouble.

The first thing I did was to measure the voltage across the contrast control which, according to the circuit should have been approximately 12. When it read only six, I was immediately suspicious and began tracing out the resistor network connected to the HT supply.

This was a rather unusual arrangement, involving resistors from both the HT line direct and from the screen of one of the IF amplifier stages, the latter being fed through a 33K dropping resistor from the HT line. This was where I found the second clue, the 33K being very badly charred, though still intact, as it turned out.

THE CULPRIT

From here it was but a short step to the real culprit, the screen of the IF valve, which showed a dead short to the suppressor. And with this discovery, all the bits of the puzzle suddenly slipped into place, making quite an intriguing story.

In the normal way, failure of an IF screen circuit would so reduce gain that the customer probably would complain of poor contrast. In this case, however, it was the one screen circuit which was tied to the contrast control, and its failure merely served to increase the contrast and largely offset the original loss.

In greater detail, failure of the screen circuit left the contrast control with only one path to the HT supply, the result of which was, as already noted, a voltage only six across it instead of the prescribed 12. In these circumstances the bias on the AGC valve could never be less than 11, a value so high that it would be extremely unlikely that any pulse in the video system would be strong enough to overcome it and produce any significant AGC voltage.

It is also significant that the set's location, aerial, and general characteristics were such that the final result was quite acceptable to the owner, so that he was hardly aware that anything was wrong. I wonder what the chances would be of a similar set of happy coincidences occurring again? Much depends, I suppose, on how poor a picture the owner will tolerate before he complains.

OWNER'S DILEMMA

Fortunately, repairs were not particularly difficult. A new IF valve restored everything to normal, though I naturally replaced the 33K as a matter of course. The only snag then was that the owner was now faced with an additional control, the purpose of which he didn't understand, and which I had to explain.

I did my best, of course, but I couldn't help wondering whether I had really done him a service or not; whether he wouldn't have been happier with one less control to worry about and in blissful ignorance that such a thing as "contrast" existed, or had to be adjusted.

And while on the subject of customer acceptance of poor quality pictures, I am reminded of an advertisement I saw recently, extolling the virtues of a new completely automatic (?), all singing, all talking, all colour camera. (You've probably seen the type of blurb to which I am referring.)

This portrayed a fond mother (suitably glamourised), proudly displaying a batch of top quality colour shots of her equally glamorous offspring. All this, while somewhat exaggerated perhaps, presented nothing really unusual in the way of advertising blurbs. What really intrigued me was the statement credited to the aforementioned fond parent.

"I know nothing about photography, but since my husband gave me this —— fully automatic camera I take perfect pictures every time, with no more trouble than tuning in the TV set."

Oh brother!

If the skill of the average person in tuning in a TV set is a fair criterion of its simplicity, then it would be about the last thing I would choose as a standard for comparison.

Still, I imagine that if the pictures out of the camera are no better than those out of the average TV set, most people would still be perfectly happy.

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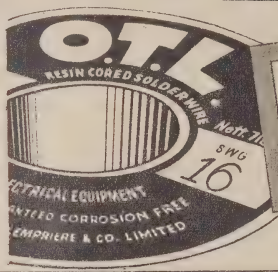

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REMOTE CONTROL FOR TV SETS

Evolutionists tell us that the most advanced forms of life are those which do not adapt to their environment but rather adapt their environment to themselves. If this is so then the TV remote control unit is just one more indication of man's justification to his claim of being a higher form of life. This article discusses some aspects of remote control, and describes the construction of a typical unit.

By P. Watson and K. Jeffcoat

THE subject of remote control for TV sets in general and our own models in particular was covered in the January 1960 issue of the magazine. Since then we have produced the 1961 TV receiver which has inbuilt facilities for remote control and is therefore ideally suited to this popular form of "laziness" (if laziness it can be called in this age of automatic transmissions, automatic defrosting, and self winding watches!).

Since much of what was said in the original article applies equally to this new control unit it may perhaps be as well to recapitulate some of our earlier remarks, before proceeding to a discussion of this particular unit.

The reason for the popularity of remote control units is not hard to find. As a form of relaxation there is nothing quite like a comfortable armchair—one into which you can really sink — soft lighting, and one's favourite TV program; whether it be variety show, drama or documentary. Just a matter of sitting back in complete physical comfort and being entertained.

At least that's the way we like to think of it. In practice, it can be very different. Before the program is many minutes' old it often becomes apparent that the volume setting which was correct for the previous program is no longer so. It is either down by sufficient to make portions of the dialogue inaudible, or up by just sufficient to be annoying. Either way you have to heave yourself out of the comfortable chair in order to reset it.

And no sooner is one resettled comfortably than the station engineer has second thoughts about the original contrast or brightness settings. So it's out of the chair again to make further adjustments. As anyone who has ever experienced it knows, it does not take many such interruptions to completely destroy the atmosphere of relaxation. What set out to be an evening's entertainment becomes a series of petty annoyances.

To make matters worse, it often is quite difficult to select settings at the receiver which remain correct when one retires to the other side of the room. Volume is one of these, for fairly obvious reasons; while brightness is another. The reason for the latter is not so obvious, but there seems little doubt that a picture which appears correct when viewed from close up to the screen will appear darker at the normal viewing distance. For the same reason contrast settings may not always be exactly optimum.

Small wonder then that we wish to take as many of these controls as possible with us to our comfortable armchair. Given such facilities we may not only make our adjustments with far less effort, but also with a good deal more accuracy.

All of the aforementioned reasons are probably sufficient to satisfy our "lazy" man as to why he should have remote control, but what about the case of the totally or partially invalided person. Here it would seem that the remote control unit moves very smartly from the "luxury" class to that of an absolute necessity.

CONFLICTING REQUIREMENTS

If such a person is placed close enough to the set to have control of it they will obviously be at an uncomfortable viewing distance. If, on the other hand, they are placed at a comfortable viewing distance, without remote control they are totally dependent on other members of the household to effect the necessary adjustments for them; a situation which must eventually become a burden to all concerned.

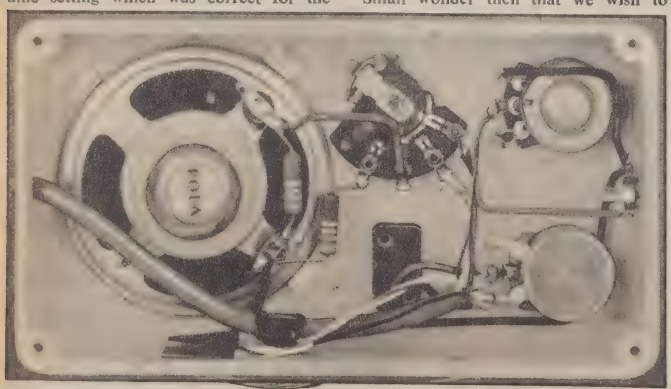
Even in the few years we have had TV in Australia a wide variety of remote control systems have been offered to the public. They range from quite simple systems with one or two controls on the end of a cord, through the ultra-ingenious "wireless" types, to the very complex which provide channel changing and fine tuning facilities as well as volume, brightness, contrast, etc.

The various forms of "wireless" control are ingenious but there is some doubt as to whether the presence of a cord is sufficiently irksome to justify all the extra components and complex circuitry involved.

Putting aside these rather fancy schemes, we feel that the average home builder is mainly interested in providing the more obvious facilities such as volume, brightness, contrast, audio muting, and possibly a remote speaker and earphone jack, in the control unit itself.

Also, we feel, there should be no objection to putting the selected facilities on the end of a cord. What is lost in ingenuity is more than made up for in simplicity, and, more important still, economy.

The earphone and remote speaker facilities are useful in several ways. A hearing aid earpiece operating directly from the audio circuit is a much more satisfactory way of serving the



Our new remote control unit is shown at the top of the page, sitting snugly in the user's hand. Among other things it provides an internal speaker or earphone jack for private listening and a function switch to facilitate selection. The rear view (above) shows the few components and simple wiring.

hard-of-hearing than by running the speaker at an uncomfortably loud level, or even trying to pick up the sound through a regular hearing aid.

Also, the remote speaker or earphone unit may be used to provide private listening facilities for one or two persons without disturbing the other members of the household. This is most useful when a favourite program occurs during the children's homework period, late at night, or whenever someone else may want to rest or sleep. It should prove invaluable in the home of a shift worker.

EXTREMES!

(Along this line we know of one couple having a control unit of this type, who, in order not to miss any of the program, regularly take the unit with them whenever they visit the bathroom. But this, we feel, is carrying a good thing too far!)

In our earlier unit we provided those facilities which, as well as not presenting any serious technical problems, were the ones which we felt would offer most in the form of a simple unit. Basically, these were brightness and volume controls, a muting switch as an extension of the latter, and a voice coil circuit extension for use of a hearing aid or personal earphone. Even so, there are a number of possible variations on this theme, to suit individual requirements.

Probably the next most popular feature would be a contrast control, on the basis that it completes the group of controls likely to be needed after one has settled down to watch any particular program. Unfortunately, this is one of the more difficult facilities, although, once again, this varies with individual circuits.

When we described the last remote control unit, we were investigating what promised to be an attractive method of contrast control. Unfortunately, it proved to be too prone to synch. pulse clipping, unless the user was fully aware of its limitations, and so had to be discarded.

CONTRAST PROBLEM

The main problem here is that we are dealing with video signal circuits extending, possibly, to 5Mc. and there is no easy way in which we can bring such circuits out to a control unit and back again without incurring intolerable losses. Thus we have to find some DC condition which, when varied, will vary the contrast.

This in itself may not be so difficult, but we must ensure that it does not distort the video signal to any serious degree, particularly in regard to synch. pulses. This can be a real hazard when used by non-technical persons who may try to correct gross maladjustment of the main contrast control by means of the remote circuit.

To date we have investigated several schemes which seemed promising, but, so far, we have not been one hundred per cent happy with any of them. We are still investigating the problem, but it looks as though we will have to postpone publication for the time being.

Finally, there is remote channel selection. Here, again, there is a wide variety of schemes available, but the basis of them all is a suitable motor to drive the turret shaft, some means of coupling one to the other, and an indexing system to allow the wanted channel to be selected.

Although a few readers may have the

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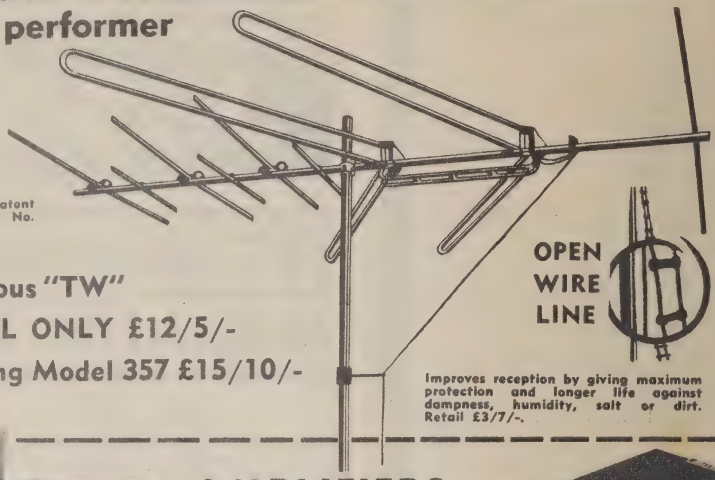

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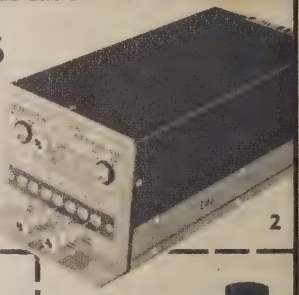

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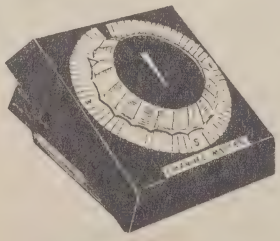

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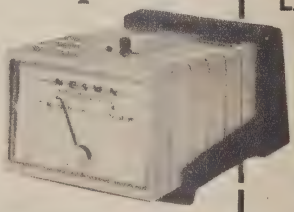

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ingenuity and facilities to make their own, most will be more interested in a ready made unit which they can fit themselves. So far there have been few such units available, but we are hoping that there will be at least one model on the market in the next few months.

For the moment, therefore, we are concentrating on audio volume — plus muting — brightness, a remote speaker for private listening, an earphone jack for the same purpose or to assist the hard of hearing, and a function switch to select whichever is required.

VARIOUS METHODS

Coming to the actual methods which may be employed to provide these facilities, we find that there are a number of approaches possible in most cases, often depending on the characteristics of the particular receiver circuit. In our case we may consider systems suitable only for our own TV receivers or those which are more universal and suitable for use with most receivers.

We have tried to work to the latter standard in regard to all the functions, and there would appear to be no reason why the unit about to be described should not be used with almost any commercial TV receiver.

Brightness control is one of the simplest of all likely facilities. The main circuit involves DC only and the auxiliary control may be simply a fairly high value pot (2M in this case) connected between the moving arm of main brightness control and chassis. The only additional components are a 100K resistor and .1 mfd capacitor added to the main chassis as a decoupling network.

As such this is intended to filter out a small amount of frame energy which may occur in this part of the circuit but which, if fed along the line with the audio circuit, can cause frame buzz in the speaker. However, the resistor has another function. It serves to limit the action of the remote control, so that the main control cannot be rendered completely inoperative, which may be confusing to a non-technical user.

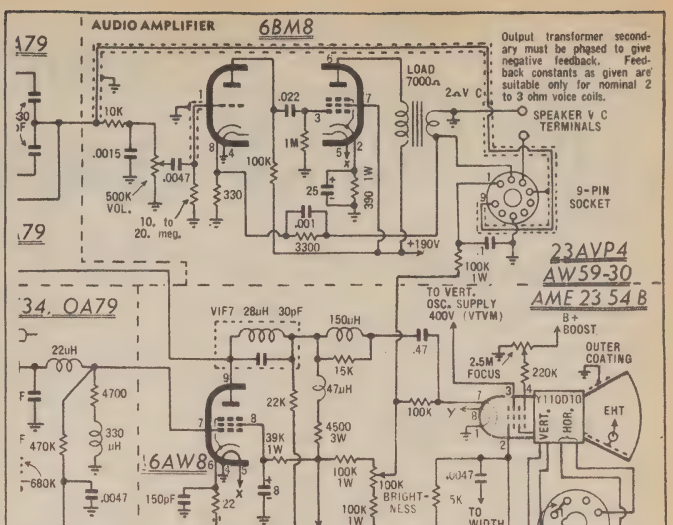
(In the case of our previous control unit, the decoupling resistor was shown as .22M, and this value is quite satisfactory in the 1959 TV receiver circuit. However, it is rather high for the slightly modified circuit of the 1961 receiver, and restricts the range of the auxilliary control too severely. In fact, the value of 100K is probably a good compromise in most circuits, but this may be varied experimentally on the basis of adequate control, some "protective" isolation, and freedom from frame buzz).

Such a circuit should suit almost any TV receiver using conventional brightness circuitry.

VOLUME CONTROL

Volume control is only slightly more complex than brightness. A number of schemes have been suggested and tried, ranging from voice coil to sound IF HT circuits. Most can be made to work, but some have obvious disadvantages or are suitable only for particular circuits.

The one which appeals to us as being least critical and most suited to typical TV circuits is a simple arrangement whereby the output of the ratio detector is progressively shorted to chassis through a 25K pot. Although the signal level is only moderate at this point, the impedance is relatively low, making it reasonably immune to hum pickup even without a shielded cable.



This is the relevant section of the 1961 TV Receiver, showing internal connections used with the remote control unit. Most should already be provided, but changes to the outlet socket will be necessary.

Where a shielded cable is available it may be used without fear of serious high frequency loss, again due to the relatively low impedance. In any case, the audio system is already adjusted to provide considerable high frequency deemphasis, in accordance with the TV standards, and could easily be modified slightly if this should appear necessary.

Once again there should be no serious difficulty in fitting this circuit to most TV receivers.

MUTING SWITCH

The muting switch is simply a parallel circuit across the volume control, but the type of switch to be used is worth some consideration. About the best type appears to be a "press on, press off" variety commonly used for reading lamps and similar applications. It needs to be a good quality unit.

Even then it may occasionally become noisy, or fail to mute completely. This condition usually can be relieved by the application of a few drops of "Servisol," "Q-Sol" or similar contact cleaners. However, make sure that the type of plastic used is not dissolved by these liquids, as may be the case with some of the cheaper switches.

The easiest way to check this is to touch the suspected material lightly with a finger or cloth moistened with cleaner. If there is any sign of softening, it is unsuitable. The switch we used is quite safe in this respect.

Extending the voice coil circuit to the remote control unit for any of the functions discussed is also a relatively simple arrangement which, once again, should be equally applicable to either our own designs or almost any commercial set.

The addition of a small speaker to the control unit is not especially difficult, but it does raise the question of a suitable cable, since the previously suggested 5-wire type is now hardly adequate.

For one thing, a function switch on the control unit is now virtually essential, and this means at least one more wire to complete the main speaker circuit back to the set. In addition, it is highly desirable to provide separate earth returns for the voice coil and volume control circuits respectively. Otherwise the system can, in certain circumstances, exhibit a tendency to audio instability.

Basically, this is simply a function of the inevitable resistance in the connecting leads, coupled with the low impedence of the voice coil circuit. The combination of these two circumstances means that a significant proportion of audio signal in the voice coil circuit will appear along these leads, including the one used to provide the earth return for the remote speaker and earphone circuit.

If this same lead is used to provide the earth return for the remote volume control, operating in the input circuit to the audio amplifier, then the output voltage along the lead will appear at the input circuit. Unfortunately, phase relations are such that positive feedback occurs, giving rise to low frequency oscillation.

NOT INEVITABLE

This is not an inevitable or continuous condition, but one which occurs only with certain settings of the various controls. For example, the main volume control will need to be set near or at full on before there will be sufficient gain in most systems, while the remote volume control will need to be well retarded, so that the input circuit is closely coupled to the earth return lead. The worst condition is where the muting switch is operated, connecting these two directly together.

Another influencing factor is the impedance of the remote speaker or earphone circuits. If these are allowed to remain high the proportion of signal developed across the lead will be so small that, in most cases, it will have no effect. However, as soon as we shunt these circuits to provide reasonable matching, trouble is encountered.

An extreme example of this is when the system is short-circuited, as when an earphone plug is pushed into the jack

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EN. MAGNET WIRE, 30, 33, 36; B. and S. . . . . **5/- lb.**
15A Car Radio Fuses . . . . **2/6 doz.**
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SPECIALS

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Stereo Amp. W'dale Speakers Collaro Player £48/10/-

VISIT OUR NEW ENLARGED
BASEMENT SHOWROOM
ELEC., RADIO, TV AND HOBBIES BARGAINS
For Australia's Largest Range.
BARGAINS IN RADIO PARTS

£5,000 Surplus Radio Stocks Sacrifice. Call and inspect our Bargain Tables.

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9-Volt Motors for Trans Record players **10/-**

OAK SWITCHES

3 Pole 4 pos. **6/-**
2 Pole 2 Pos. **3/6**
2 Pole 1 Pos. **1/-**
2 Pole 2 Pos. with off pos. . . . **4/-**

Scope Soldering Irons

Standard Iron **£2/16/-**
Transformer **£2/14/-**
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Coppertips **11d**
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Cowl and Universal Aerials **£2/19/9**

TRANSISTOR Telephone Handsets

Two way communication up to 15 miles—twin wire hookup.
HIGHLY EFFICIENT
£12 Pair

BLOCK CONDENSERS

125v.		400v.	
1 mfd. . .	**7/4**	1 mfd. . .	**8/6**
2 mfd. . .	**8/-**	2 mfd. . .	**10/6**
4 mfd. . .	**11/9**	4 mfd. . .	**14/11**
8 mfd. . .	**20/-**		
16 mfd. . .	**33/5**		
40 mfd. . .	**55/-**		

Indoor Aerial wire 25ft. Coils . **1/-** ea.
Push back hookup wire Ass. colours 100ft. Coil. . . . . **5/-** coil.

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Collaro Display turntable, 4-speed, easy converted back to record turntable **£2/10/-**
Speaker Transformer 7,000 ohm. **5/-** each. Few only.

CONDENSERS—CERAMIC

4.7, 12, 8, 27, 32, 50, 95, 100, 1500, 2.2 . . . . . **9d** ea.

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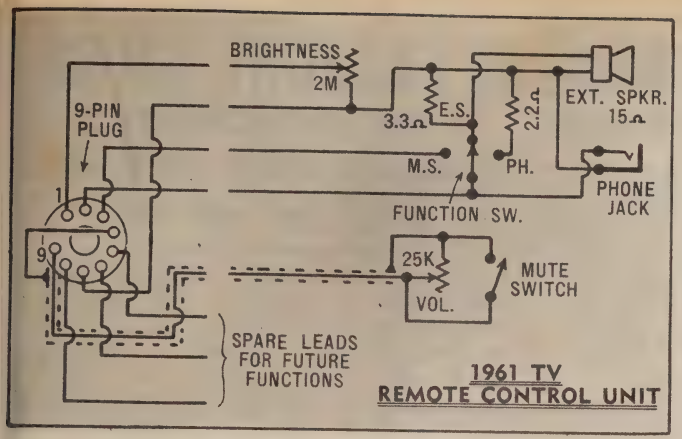
2000—2.5v ET	6d	24—150v EC	2/-
500—12v EC	2/-	20—200v ET	2/-
500—12v ET	2/6	16—450v EC	6/-
400—12v EC	2/-	15—15v ET	2/-
250—16v ET	1/-	10—40v ET	1/-
100—2v ET	1/-	8—500v EC	3/-
100—6v ET	1/-	8—350v EC	2/-
50—3v ET	1/-	2—200v ET	1/-
24—150v ET	2/-		

CONDENSER—MICA

8, 6, 15, 35, 100, 120, 75, 180, 200, 300, 350, 250, 1000 . . . . . **6d** ea.

Call or Write NOW! **290 LONSDALE ST., MELB. FB3711.** ***Trade Supplied***



Circuit of the complete unit. Note the use of separate earth return leads for the voice coil and volume control circuits to avoid audio instability.

and briefly bridges the jack contacts. The result is a loud "raspberry"-like note.

While some readers may feel that these are not serious problems, provided the controls are used intelligently, they can be disconcerting to the non-technical user. The only sure way to avoid them is to use a second lead as an earth return for the remote speaker and earphone circuit, making a requirement of six leads in all.

NEW CABLE

Fortunately, a suitable cable is now available. It contains eight wires, one of which is shielded, making nine conductors in all. Although we have not found a shielded wire to be strictly necessary in the audio circuit, advantage might just as well be taken of it where it is available.

Two of the wires in this cable are slightly heavier than the others, and are a natural choice for the main speaker circuit, where minimum resistance is desirable. Connection to the set is via a nine pin plug and socket combination.

To accommodate a nine pin socket, the existing chassis hole in our own set will need to be enlarged, and this is best done with a screw type socket punch, if one can be made available. This is preferable to filing, which may upset adjustment of tuned circuits. Nine pin plugs to suit these sockets are readily available.

The selector switch is a simple single pole, three position type, such as the MSP series 20. The active voice coil lead is brought from the set to the moving arm of the switch, from which it is directed either back to the set speaker by another conductor, or the miniature speaker. The third position disconnects both speakers.

Since the earphone outlet may need to be used as a hearing aid, even while either speaker is operating, it is left permanently in circuit, the third switch position merely serving to bring a resistive load into circuit to replace the voice coils.

One problem in this set-up concerned the relatively limited power (250 mW) which may safely be fed to the miniature speaker. While the user is unlikely to operate this at high level intentionally, there is a very real risk that, when switching from the main speaker running at normal volume, the remote speaker may accidentally receive more power than is good for it.

Fortunately, this problem more or less solves itself. The speaker selected is one of the nominal 2 inch models, available in both Rola and MSP brands, and having a 15 ohm voice coil. When used on a 2 ohm or 3.5 ohm system, there is a convenient reduction in power, and a resistor shunted across the speaker voice coil preserves the nicety of impedance matching. A value of 3.3 ohms is a good compromise for either system.

If a 15 ohm system is used it would be advisable to use a resistor in series with the voice coil, as well as one in parallel, values being chosen so as to provide a substantial reduction in power to the speaker while retaining a reasonable impedance match for the output stage. A 12 ohm series resistor and a 4 ohm shunt resistor would be typical values, but these may be varied slightly if required.

As shown in the 1961 TV Receiver circuit, the audio lead within the chassis is shielded. This is much more important in the chassis than elsewhere, due mainly to the presence of a strong, but fairly confined field of 15,625 cps signal from the line oscillator and output components.

LEAD DRESS

For best results we suggest that this cable be run from the ratio detector panel to the front of the chassis, along the front fold and then the side fold to the control socket near the speaker terminals. The shield should be earthed at the ratio detector panel and terminated on one of the socket lugs, but not earthed at this point. The shield in the remote cable will also terminate on this pin.

The case is made from a small white plastic box, such as we have used for a number of previous projects, one of the most recent being the Electronic Metronome, of April, 1961. It measures approximately 6¾ x 3¾ x 2¾in. For this job it is cut down to a depth of 1 7-16in external, a figure dictated largely by the depth of the speaker magnet.

A grill of holes is drilled in the

(Continued on Page 109)

THE "OXFORD" CASE

RECTANGULAR OR SQUARE		
MC4	7 x 4 x 4 ..	17 6
MC5A	With louvred ends 9 x 6 7/8 x 5½	1 5 0
MC5	Al. Chassis ..	16 6
MC6	6 x 6 x 6	1 3 0
MC6L	With louvre ends 6 x 6 x 6	1 5 0
MC6	Al. chassis ..	16 6
MC62	6 x 6 x 2½ ..	1 0 0
MC67	12 x 7 x 6 ..	1 12 6
MC67	Al. chassis ..	1 3 6
MC7	10 x 8 x 7 ..	1 12 6
MC79	15 x 9 x 7 ..	2 12 6
MC81	10 x 10 x 8 ..	1 15 0
MC811	12 x 11 x 8 ..	2 2 6
MC82A	With louvred ends 13 x 8 x 6 7/8	2 2 6
MC82A	Al. chassis ..	1 4 6
MC87A	With louvre ends 15 x 10 x 8	2 12 6
MC87A	Al. chassis ..	1 7 6

Open at largest side.

OXFORD SLOPING FRONTS.

With full lift-out front.

S.F.7	7 x 6½ x 7¼ ..	1 5 0
S.F.79	9 x 6½ x 7¼ ..	1 10 0
S.F.71	11 x 6½ x 7¼ ..	1 15 0
S.F.8	13 x 8 x 8	2 2 6
S.F.9	15 x 9 x 9	2 10 0
S.F.10	18 x 10 x 10 ..	2 12 6

With only slope panel removable

S.F.7A	7¼ x 7¼ x 7 ..	1 5 0
S.F.79	9 x 6½ x 7¼ ...	1 10 0

All cases plus 12½ per cent tax.

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McKINNON & NICHOLLS PTY. LTD.
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NEW PORTABLE 4 SPEED RADIOGRAMS

- FIVE VALVES.
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- 7" x 5" SPEAKER IN FELT LINED ENCLOSURE GIVES EXCELLENT REPRODUCTION ON RADIO OR YOUR FAVOURITE RECORDINGS.
- ATTRACTIVE TWO TONE COVERED CABINET WITH PLASTIC TRIM. DIMENSIONS 15" x 13" x 17"

£25/17/6

Packing and Post., N.S.W. £1. Interstate 30/-.

PORTABLE RECORD PLAYER
AS ABOVE BUT LESS RADIO £17/17/6
Plus freight as above

NEW PER-MAG SPEAKERS
by Australian leading manufacturer
AT LESS THAN HALF PRICE
(We cannot advertise the name)

		POST AND PACKING N.S.W.	Interstate
5in Per Mag	22/6	3/6	4/6
5in x 7in Per Mag	22/6		
6in x 9in Per Mag	32/6	5/-	7/6
8in Per Mag	32/6		
12in Per Mag	47/6	7/6	10/-

Speaker Transformers for above 5T or 7T 10/-

2,000 YDS TYGAN AND SARLON SPEAKER GRILLE FABRIC
All popular colours 54" wide. List price 60/- per yard. To clear at 20/- per yard
Postage and packing N.S.W., 3/6; Interstate, 4/6.

SCOOP PURCHASE OF POTENTIOMETERS RESISTORS AND CONDENSERS

We have purchased the resistor and condenser stock held by Bush-Simpson who have ceased the manufacture of TV and radio equipment.
The resistors are mainly I.R.C. and include most standard values from 200 ohms to 5 meg. in ½, 1, and 2 watt. Also some wire wound. List price £4/10/ per 100.
The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in most popular values. List price £5/10/ per 100.
The potentiometers are all current types and include switch pots and dual concentric. List price £6 per doz.

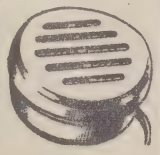
SPECIAL PRICE
Resistors or condensers in boxes of 100 mixed values 20/-. Post and packing 2/9.
Potentiometers, 25/ per doz. Post and packing 2/9.

NEW ELECTROLYTIC CONDENSERS AT LESS THAN HALF PRICE

100 mfd + 200 mfd 350v	8	6
8 mfd 350v	2	3
16 mfd 300v	2	3
32 mfd 275v	2	6
100 mfd 12v	2	0
50 mfd 12v	2	0
25 mfd 25v	1	6

POST EXTRA

PILLO-FONE EXTENSION UNIT
IT'S A REAL MINIATURE WITH ROLA UNIT



Install it anywhere, in the sick room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLOFONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾ in. deep. POST FREE.

22/6

GARRARD RECORD CHANGERS 3-SPEED 32 V.D.C.

New English Garrard Record Changers fitted with high fidelity turnover Crystal Pick-up, Sapphire Needles. For 32-volt D.C. operation. Can be used on any D.C. voltage exceeding 32V with External Resistance.

£9/15/- F.O.R.

NEW 4-SPEED PLAYERS
With turnover Crystal Pick-up

£8/10/- POST N.S.W., 7/6. INTERSTATE, 12/.

NEW STEREO CHANGER, 4-SPEED. F.O.R. £12/15/

NEW 4-SPEED STEREO PLAYER F.O.R. .. £10/10/

SLIDER-SWITCHES
10 pole 2-way silver plated contacts. 3/9

BURGESS MICRO-SWITCHES
Can be wired to switch circuit on or off. 3/9

Making a TRANSISTOR PORTABLE?

Success assured with R.C.S. COIL KITS and PRINTED CIRCUIT BOARD

COMPLETE KIT OF PARTS FOR THE TRANSISTOR SEVEN

With NEW R. F. STAGE which increases Signal and reduces Hiss.

£25/17/6 SET WIRED AND TESTED £2/10/- EXTRA

Complete kit of parts for the Transistor 7, including 7 Transistors, Printed Circuit Boards, Coil Kit, Rola 5F Speaker and Transformers and all necessary parts to complete this set including attractive and durable two-tone cabinet with gold trim. Fitted with special aerial coil and plug to connect to your car aerial or external aerial making it an ideal car set or for use in the country.

POSTING AND PACKING EXTRA. N.S.W. 15/- on transistor 7 sets. INTERSTATE 22/-.

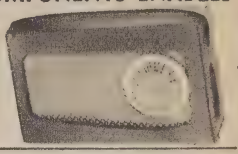
NEW MINIATURE COILS and I.F. TRANSFORMERS: Aerial, R.F. or Oscillator Coils, 7/6 ea. Post 1/. I.F. Transformers, 9/6. Post 1/. Short Wave Coils, 16 to 49 metres, 5/6 ea.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398

COMPLETE KIT FOR TRANSISTOR 6 PORTABLE £12/17/6

SCOOP PURCHASE OF MANUFACTURERS STOCK OF TRANSISTOR COMPONENTS ENABLES US TO SUPPLY THIS KIT AT NEARLY ½ PRICE



The complete kit of parts for the Transistor Six includes 6 transistors, printed circuit board, coil kit, Magnavox 4T speaker, Ferguson transformers, battery and all necessary parts to complete the set, including an attractive plastic covered case.

CAN BE SUPPLIED WITH LEATHER CASE AT 20/- EXTRA.

Wired and Tested, £2 extra. Dials available for all States.

POST AND PACKING EXTRA. N.S.W. 8/6, INTERSTATE 12/6.

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6J6	12/	EK32	6/9	1K8G	2/6	6H6GT	2/6
1C4	7/6	6SA7GT	9/6	1M5G	3/	6K7GT	7/9
1T4	4/6	6SH7	8/6	1K7G	3/	6U7G	5/
3S4	10/	1Q5G	2/6	6C8G	5/	7C7	3/6
1R5	10/6	1P5G	2/6	6S87	8/6	78	7/6
1A7GT	9/6	1C7G	3/	6H6	2/6	6B6G VR55	5/
1D8GT	9/6						
6K8G	6/9						
6SJ7GT	9/6						
12K8	10/						

6AC7	8/6
VR65A	2/6
7193	2/
12A6	8/
EF50	2/6
12SH7	5/
6K7G	4/6
955	2/6
954	2/6

Please add postage on all valves.

NEW VALVE SOCKETS: Ceramic EF50 Sockets, 2/6 ea. American moulded Loctal, 1/ ea. Octal 8-pin wafer, 6/6 doz. 5BP1 socket Ceramic, 7/6. Amphenol 5-pin ceramic, 2/6 ea. 7 and 9-pin Miniature, 1/ ea. All Postage Extra.

NEW 4 SPEED RECORD CHANGERS

THESE NEW 4 SPEED RECORD CHANGERS ARE EQUIPPED WITH HIGH FIDELITY CRYSTAL PICK-UP AND SAPPHIRE NEEDLES. CAN ALSO BE USED AS A MANUAL PLAYER.

£10/15/-

F.O.R.

TAPE-RECORDER MOTORS

New Collaro Tape-Recorder Motors. 240 volt. A.C. Adaptable for many uses.

37/6 Post Extra.

CONTACT RECTIFIERS

Westinghouse Selenium Rectifiers, ideal for small sets or test equipment. 120V A.C. 60mA output. 6/9, post free.

NEW MULTIMETERS—61/- POST EXTRA

METER 0-1mA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0—10v	0—10v	0—1MA
0—50v	0—50v	
0—250v	0—250v	0—100MA
0—500v	0—500v	
0—1000v	0—1000v	0—500MA

SUPPLIED COMPLETE WITH TEST LEADS. RANGE 0-100,000 OHMS.

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., 37/6. Post: N.S.W., 7/6; Interstate, 10/-.

Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6. Post, N.S.W., 7/6; Interstate, 10/-.

As above, 6 or 12 v. at 2 amp., 27/6. Post: N.S.W. 3/6. Interstate 4/6.

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NEW. RECORDING TAPE.

Well known make Hi-Fi Recording Tape. P.V.C. base 5in spools. 600ft. 20/-. Post 1/6.

DUAL CONCENTRIC POTENTIOMETERS

1 meg + 200K + switch.
.5 meg + 50K + switch.
1 meg + 5K.
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SINGLE CRYSTAL EAR PHONE 7/6

STANDARD INTERMEDIATE FREQUENCY TRANSFORMERS

455Kc, 1¼in square cans. Slug tune. 4/9 post extra.

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New Rola 9 x 6 speakers in case with volume control. 75/. Post Interstate 5/6. N.S.W., 4/.

NEW HIGH IMPEDANCE HEADPHONES

2000 ohms 25/-
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60mA prim.: 240v with 230v tapping. Sec. 285 x 285 with 6.3v filament winding 60mA.

25/- Plus postage, N.S.W. 3/6, Int., 5/3.

NEW MIDGET POWER TRANS.

40mA prim., 250v. Sec. 225 x 225 with 6.3v Fil. Winding. **27/6** Postage: N.S.W., 2/6; Interstate, 4/6.

30mA 240v Prim. 150 x 150v. Sec. with 6.3 v Fil. Winding. **25/-** Postage: N.S.W., 2/6 Interstate, 3/6.

MICA AND CERAMIC CONDENSERS

Standard Mica Condensers, small current types .00003 and .005, including most wanted values.

10/- per 100. Postage 1/6.

NEW 15 WATT AMPLIFIERS

These 15w P.A. Amplifiers using 6 valves, including EF86 Microphone Pre-amplifier and 6BQ5 valves in push-pull, with Ferguson Output Transformer with voice coil tappings of 2 to 15 ohms.

Inputs for Microphone, Radio and Pick-up with mixing facilities and tone control.

Unit supplied in Hammertone-finished metal case

£18/17/6

Post, N.S.W., 10/; Interstate, 15/.

12in Rola Speaker for above (10 watt), 57/6.

CRYSTAL MICROPHONE FOR AMP. 47/6.

NEW 25 WATT AMPLIFIERS

As above, but using 2-EL34 valves in push-pull output.

£26/17/6

Post N.S.W. 15/. Interstate 20/.

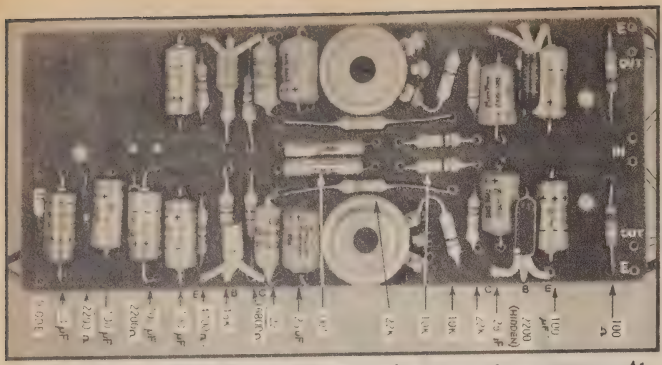
NEW POTENTIOMETERS

with SWITCH STANDARD SPINDLE	WITH SWITCH SHORT SPINDLE	LESS SWITCH STANDARD SPINDLE	LESS SWITCH SHORT SPINDLE	TAB. POTS.
500,000 ohms. 100,000 ohms	100,000 ohms. 500,000 ohms.	200,000 ohms 100,000 ohms. 500,000 ohms. 5,000 ohms.	500,000 ohms. 50,000 ohms. 2 meg.	25 k. 250 k. 1 meg. 2 meg.
5/6 ea. 50/ doz.	2/6 ea. 24/ doz.	3/6 ea. 33/- doz.	1/9 ea. 16/ doz.	2/- each.

25,000 ohm screwdriver adjustment, 1/9.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398



Here is a view of the AC powered version of our new stereo pre-amp. At the lower left is the power supply section, featuring a miniature silicon diode. Centre and right are the two amplifier channels, which are symmetrical.

A TRANSISTOR PREAMP. FOR MAGNETIC PICKUPS

Here is a compact, four transistor pre-amplifier which enables owners of existing crystal-pickup amplifiers to convert easily to a magnetic pickup. Built on a small printed-wiring board, it incorporates high but variable gain in each channel as well as full R.I.A.A. compensation. A built-in power supply allows operation from the amplifier HT line, a heater transformer or a low-voltage motor winding.

FOR some time now, we have been contemplating the construction of a transistorised magnetic pickup pre-amp. However, we had serious reservations about the project until a short while ago, for we felt that the noise-level and general performance of the then-available transistors would preclude serious consideration.

Our view changed considerably, when we had a chance to operate and test the recently released transistorised pre-amp manufactured by the people who make the Labcraft turntables. This unit was supplied for testing by Messrs G.R.D. Instruments Pty. Ltd., and was discussed by the Editor in the August, 1961, "Off the Record" article.

Measurements and listening tests on this unit indicated that transistor pre-amplification of high quality, yet having an extremely low hum and noise level, was quite practicable. In fact, the hum and noise level of the unit was equal to, if not better than most valve pre-amps.

OVERSEAS TYPES

The transistors used in the device, however, were overseas types, and not in plentiful supply locally. Thus, although the unit showed that transistor pre-amplification was both practical and successful, it did not solve the problems involved in designing and describing a unit for home construction.

The final development in the train of events, leading up to the unit described on these pages, was the release, a few weeks ago, for general domestic applications, of several low-noise audio transistors.

The Mullard firm started the ball rolling with some samples and data for the AC107, a low-noise transistor similar in most electrical characteristics (except noise) to the well-known OC44. Examination of the data suggested that here at least was a suitable transistor for our purpose — a fact which tests have since confirmed.

Next, we were informed that the Amalgamated Wireless Valve firm had a similar transistor available, the 2N220. It is alternatively known as the 2N175, when fitted with a special non-microphonic short-lead base.

Investigations revealed that the Ducon Company had similar transistors available, designated SFT152.

Armed with this knowledge regarding the availability of suitable transistors, we set about developing our own pre-amplifier.

We decided that it would be primarily a stereo unit, capable of boosting the output from a stereo magnetic pickup to a level suitable for a Crystal Control Unit or other amplifier having only crystal pickup facilities. The correct magnetic pickup R.I.A.A. compensation was to be included, to provide balanced reproduction without further complication, with gain sufficient for all current model pickups.

We also felt that some form of gain adjustment was desirable, to allow the unit to cope satisfactorily with both medium and low output magnetic cartridges. Finally, distortion was to be at least as good as a comparable valve pre-amp, with an average-level harmonic distortion of less than 0.2 per cent.

The unit pictured on these pages represents the result of our efforts. With two transistors per channel in a direct-coupled amplifier circuit, it has a maximum mid-frequency gain of approximately 250 times. Frequency-selective negative feedback and low input impedance combine to give the unit a compensation curve which is within 2 dB of the R.I.A.A. curve at worst, while the distortion is 0.15 per cent at average listening level with a typical magnetic cartridge.

The unit may be constructed in either of two versions.

The preferred version has a built-in rectifier and filter circuit which allows it to be powered from a low-voltage winding on a turntable motor or from a small 12-volt heater transformer.

The other has a divider and zener diode regulator circuit to allow operation from the HT line of the Control Unit in the existing amplifier.

PRINTED BOARD

Battery operation is also possible if you happen to prefer it that way.

Constructed on a printed wiring board, the unit may be mounted underneath the motor board or attached to the Control Unit itself (either externally or internally). Being of low impedance throughout, the unit is relatively insensitive to hum pickup and does not require elaborate shielding arrangements. We would not recommend bolting it to your motor or power transformer, however — you can push things too far!

A glance at the circuit should help in understanding the operation of the pre-amp. Fundamentally, each channel consists of two transistors in a direct-coupled cascade arrangement. Both are acting as common-emitter amplifier stages.

For DC stabilisation, both transistors are fitted with emitter swamping resistors. In addition, direct negative feedback from the emitter of the second stage to the base of the first stage allows each transistor to effectively stabilise the operating point of the other. A stable DC loop thus results.

In tests we found the unit to perform quite happily up to 125 degrees Fahrenheit, after which it drops in gain and current drain. Higher temperatures result in the gain dropping to zero (at approx. 140 degrees) and the transistors cutting off — but without damage.

By Jamieson Rowe

Note that gain adjustment of each channel is secured by using a preset "tab" potentiometer as part of the DC feedback line. The moving connection of the pot is connected to an electrolytic capacitor, bypassing it to earth. In the maximum gain position, this capacitor is connected directly across the 4700 ohm emitter swamping resistor of the second stage, and stops regeneration across this resistor.

By moving the capacitor away from the emitter resistor with the pot, the gain of the second stage drops, due to degeneration across the resistor. The feedback to the first stage is still purely DC, since the capacitor bypasses the feedback path. Note also that DC conditions and frequency response are unaltered by the gain adjustment, which alters the channel gain by a ratio larger than 2 to 1.

This is not an enormous figure but it does allow the unit to cope with cartridges currently available and having different orders of output voltage.

The correct frequency compensation is obtained in two ways. Firstly, use is made of the fact that a magnetic cartridge is effectively a generator with an inductive source impedance. If such a generator is fed into a low impedance resistive load, the load voltage will drop with increasing frequency.

In other words, the pickup cartridge can be visualised as a voltage generator in series with an inductor, whose reactance will obviously decrease as the frequency is reduced.

At very low frequencies, the inductive reactance will be so small that it will not reduce markedly the proportion of "generator" voltage which reaches the load. With increasing frequency, and assuming the load to be resistive and of relatively low value, the voltage divider effect will become more evident, with a consequent progressive reduction in the voltage reaching the load.

The preamp makes use of this effect by reason of its naturally low input impedance. Most "medium impedance" magnetic cartridges would appear to have sufficient inductance to produce a considerable proportion of the desired bass-boost characteristic.

(NOTE: Magnetic pickups of the very low impedance type will not operate satisfactorily, due both to their very low output voltage and to their very low inductance. With such types the usual step-up transformer may solve the problem, but we have not had opportunity to confirm this.)

EXTRA COMPENSATION

On its own, the input impedance-pickup inductance effect will not yield sufficient compensation for correct reproduction, and must be supplemented by other means.

Additional frequency compensation is provided by a second negative feedback circuit, from the second stage collector to the first stage emitter circuit. The combination of resistors and capacitors used results in an overall curve which follows the recommended R.I.A.A. curve quite closely. Balanced reproduction is thus ensured.

Output from each channel is taken from the collector of the second stage transistors and, with typical magnetic pickups, will be of the order of 250 to 500 millivolts. It is thus suited for feeding directly into the input circuitry of Control Units and amplifiers designed for crystal pickups and having some form of input gain control.

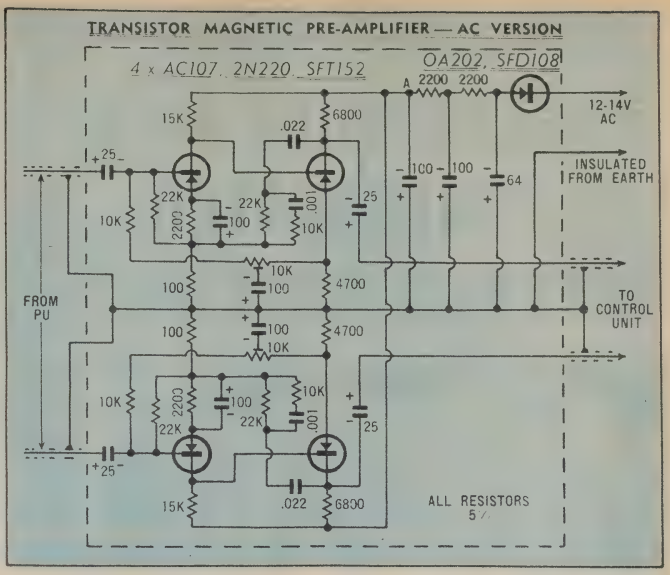
Note that the signal should not be fed into other preamplifier circuits lacking an input gain control, since overloading would almost certainly occur. Also, since the transistor preamplifier provides all the necessary frequency compensation, further fixed compensation could only be an embarrassment.

Now for the power supply section of the unit.

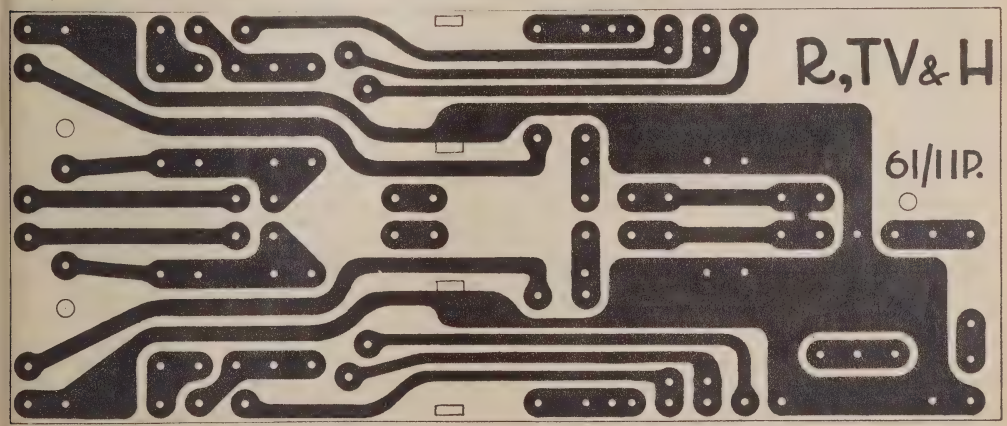
As we said earlier, the modest current drain of the preamplifier can be met very easily by a 9 to 12-volt battery supply and this would be the obvious course if the unit were to be used with battery driven transistor power amplifiers. In fact, some may prefer battery power in any case.

Omit all the power supply components shown except the 100mfd. electrolytic from point A to earth. This should be retained as a precaution against cross-talk between channels, should the battery impedance rise unduly with age. An "off-on" switch may also have to be fitted.

For those who may not fancy using a battery, the unit may be operated either from 12 to 14 volts AC, with an in-built rectifier and filter system, or from 80-300



Here is the circuit for the AC powered version of the new preamp. Using two transistors per channel, it provides variable gain and full magnetic pickup compensation. Note that, with this version, the pickup shield braid connection connects to the amplifier earth only via the preamp, to prevent the formation of earth loops and consequent hum troubles.



Here is a full-size reproduction of the basic printed wiring board, which will serve for either the AC or DC versions of the preamp. Readers who desire only a mono version of the unit should note that where space is at a premium, the board may be cut in half and the unused half discarded. A modified drawing of this board is given later in the article for readers wishing to mount the unit on the rear of a Crystal Control Unit.

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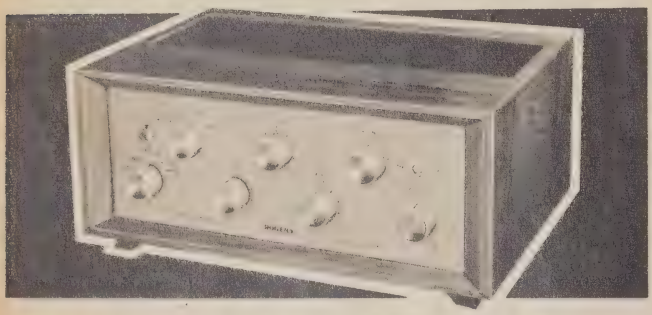

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volts DC, obtained from the Control Unit and dropped to a suitable level.

The AC supply is rather more straightforward, in that no polarity problems are involved.

With DC supply, obtained from the amplifier, polarity problems have to be faced, of the usual type, when transistors requiring a negative supply are associated with valves having a positive supply.

To minimise risk of confusion, separate circuits are included.

The AC version incorporates an OA202 or SFD108 silicon diode as a half-wave rectifier, followed by a resistance-capacitance filter circuit. The required supply voltage may be obtained from a winding on the turntable motor (such as in the case of some Labcraft motors) or from a small 12-volt heater transformer (such as the Ferguson type PF1728 or similar). Current drain is approximately 2 milliamps.

PARTS LIST FOR 12-14V. AC VERSION

- 1 Printed circuit board, as per drawings.
- 4 Transistors, type AC107, 2N220, or SFT152.
- 1 Silicon diode, type OC202 or SFD 108.
- 2 x 10K tab potentiometers.
- Half watt 5 per cent resistors: 2 x 100 ohm, 4 x 2.2K, 2 x 4.7K, 2 x 6.8K, 4 x 10K, 2 x 15K, 4 x 22K.
- Capacitors: 2 x 0.001 mfd paper, 2 x 0.022 mfd paper, 4 x 25 mfd 25v electrolytic, 1 x 64 mfd 16v electrolytic, 6 x 100 mfd 16v electrolytic.
- Shielded connecting cable, solder, etc.

The power transformer used to supply the pre-amp may be mounted under the motor board of the player, and connected to the same mains source as the motor. For convenience, it may be switched on and off with the motor, as the transistors require no warmup time and function immediately upon switching on.

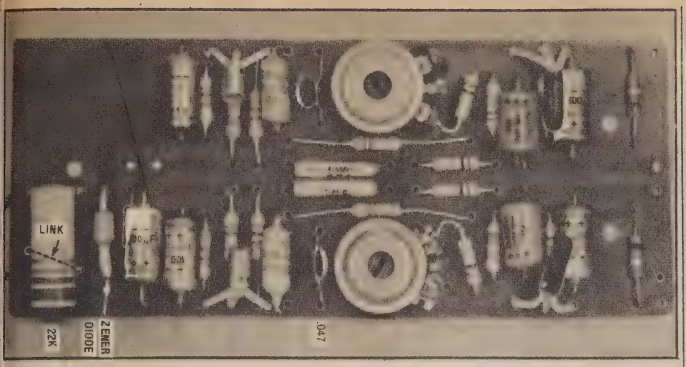
Note that the AC supply to the transistor board must be insulated from earth and therefore cannot well be derived from any arrangement of the normal amplifier heater wiring. Apart from the difficulty of a conflict between earthing of the AC and DC circuitry, there is the additional possibility of creating hum loops affecting the signal circuits.

The question of hum loops due to multiple earthing is most important in any amplifier system operating at the low signal levels involved by modern magnetic stereo pickups.

As a first precaution, the motor and motor plate system must NOT be earthed via the pickup wiring and simultaneously via its own power leads. Ideally, the body of the pickup and the cartridge wiring and braid should all be isolated from the motor plate and earthed via the transistor preamplifier wiring back to the input of the Control Unit.

If the body of the pickup and the braiding has to connect to the motor plate, at least keep the pickup leads separate therefrom and earth one of them to the preamplifier. Connect the motor plate to whatever point gives the lowest hum but do NOT have it returning to both preamplifier chassis and the power point earth.

The alternative version, which is de-



This is a top view of the DC version, showing the components. Note the new output coupling capacitors, the altered power supply circuitry and the reversed polarity on the input coupling electrolytic capacitors compared with the other version. Apart from these features, the board itself is the same. Earth braid connections differ, however, and these should be noted.

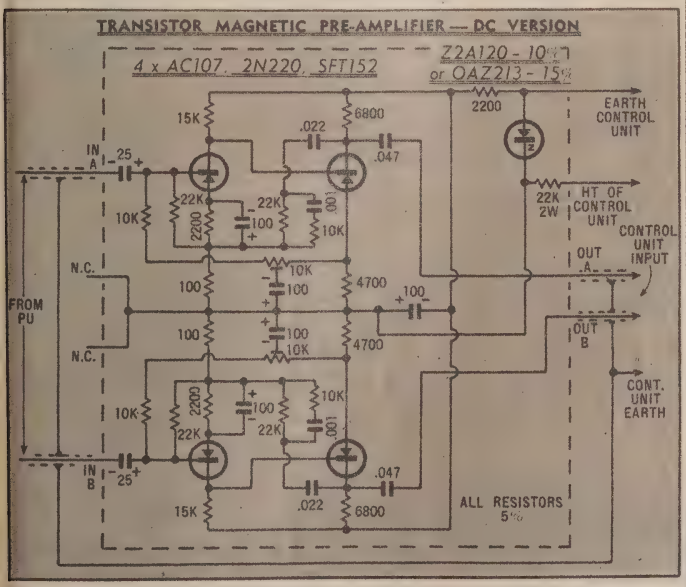
signed to derive its power from the HT line of a conventional crystal control unit or amplifier, has a somewhat simpler power circuit. This is a single stage R-C filter circuit preceded by a divider circuit having as its lower element a zener diode. The diode used may be either an STC type Z2A 120 (10 per cent) or a Mullard type OAZ213 (15 per cent).

With these zener diodes and the series resistor value shown (22K 2 watt) the unit will operate quite satisfactorily from voltages ranging from 80 to 300 volts. However, the current drain will vary considerably over this range, due to variation in the diode current.

Thus, at high voltages the current drawn from the amplifier power supply may be embarrassing, even though the pre-amp and zener diode are well within ratings. Conversely, voltages lower than about 80 will be insufficient to produce correct operation of the zener diode.

Accordingly while we have quoted a series resistor value (22K) which will give perfectly satisfactory pre-amp operation for all usual Control Unit HT voltages, some cases may warrant adjustment. In such cases, we would recommend that the series resistor be adjusted to set the total current drain at about 6 milliamps; this will mean a value greater than 22K at high voltage, or less than 22K at low voltages.

In this version, polarity problems are involved by the fact that a transistorised device, requiring a negative supply, is to be supplied from a valve system having a positive HT system. Thus the coupling capacitors, which can as easily



The circuit for the DC powered version differs little from the previous version except for the power supply circuitry and the coupling capacitors. Note that the input coupling electrolytics are connected the opposite way to that used in the AC version, due to the different working conditions. Incorrect polarity of these capacitors will seriously impair operation due to capacitor leakage.

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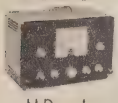
O. 12u

G.D - 1B



H.D - 1

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A.G - 9A

A.R - 3

S - 88

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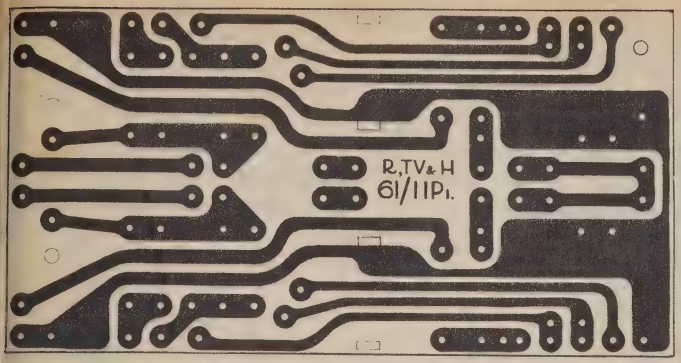

Here is the reproduction of the modified printing wiring board, a short version which will fit on the rear of our Crystal Control Units. Note that it does not provide for mounting of the zener diode, 22K resistor or 2.2K resistor. These may be fitted to a tagstrip within the Control Unit. (This board will serve without further components as a battery version, if desired.) Also note that this reproduction IS NOT FULL SIZE, but reduced in scale, the actual size being 2⅜in x 5¼ ins.

be electrolytics in the former case, are best changed to paper types, knowing that this version will only be used with high impedance valve input circuitry.

Secondly, the earth braid of the pick-up does not connect to the board at all, going directly to the chassis of the Control Unit. If the transistor pre-amplifier is attached to the Control Unit, the existing pickup sockets can as easily be retained, the active leads only looping back out to the pre-amplifier input; the output leads can then come back into the case and to the function switch cum volume control wiring.

CONSTRUCTION

As the photographs show, the unit is constructed on a printed wiring board measuring 2⅜in x 6¼in. This size may fit inside many Control Units. If it is preferred, however, the unit may be fitted outside the Control Unit case or under the motor board.

For readers desirous of mounting the unit on the rear of one of our own Crystal Control Units, we have prepared a special short version of the board. This board, shown on the top of this page, is short enough to mount between the power supply socket and the input sockets on the rear.

The board does not provide for the zener diode, the 22K and the 2.2K resistors, which must be mounted on a tagstrip within the Control Unit.

Bolt the board to the control unit on short spacers, and wire up the power supply components. Connect the existing input sockets up to the pre-amp input, and take the pre-amp output to the old input connections of the Function Switch in the Control Unit.

Note that the short printed board may be used for a battery version of the pre-amp if desired. Simply connect the battery to the board across the 100 mfd capacitor, in place of the zener divider circuitry.

We understand that the printed wiring board will be available from at least two local manufacturers very soon after this issue is released. Readers who wish may "roll their own" however, using the reproduction given on these pages. (Note also that readers who wish may construct the pre-amp using normal wiring techniques if printed wiring boards are unavailable or disliked. Layout is not critical).

If a monophonic pre-amplifier only is required, the unit may be wired in a single-channel version. The unused portion of the board may be retained or cut off, depending upon the available space.

Using the photographs and diagrams supplied it should be easy to construct the pre-amp in all forms. The main point to watch in assembly is that the joints are well made without overheating the miniature components. When soldering the transistor leads, use a pair of pliers to grip the lead between the joint and the transistor. This will act as a heat sink and prevent heat conduction from damaging the transistor.

This completes the description of our new transistor pre-amp. If a little care is taken with its assembly, first class reproduction will be assured with your existing crystal pickup amplifier and a new magnetic cartridge.

British-American Project To Test Communication Satellites

(Continued from Page 17)

ror for microwave signals. Directed at the sphere from a powerful transmitter, the signals are reflected downwards to a remote receiving point far beyond the normal horizon for microwave transmission.

The active type, on the other hand, is a small sphere—no more than two or three feet in diameter—but packed internally with electronic equipment and coated externally with solar cells to turn the sun's rays into electrical power. These units receive the initial signal and re-transmit it to the distant point.

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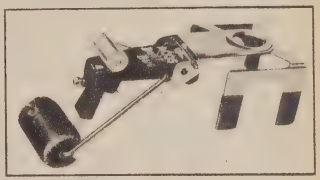
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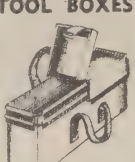

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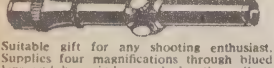

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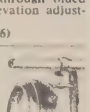

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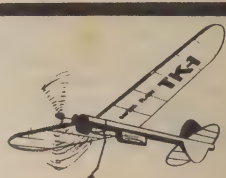

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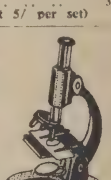

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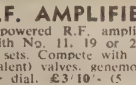

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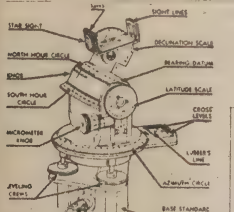

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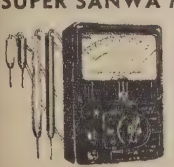

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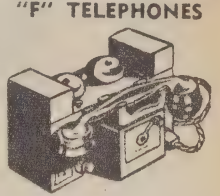

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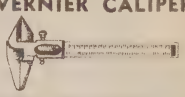

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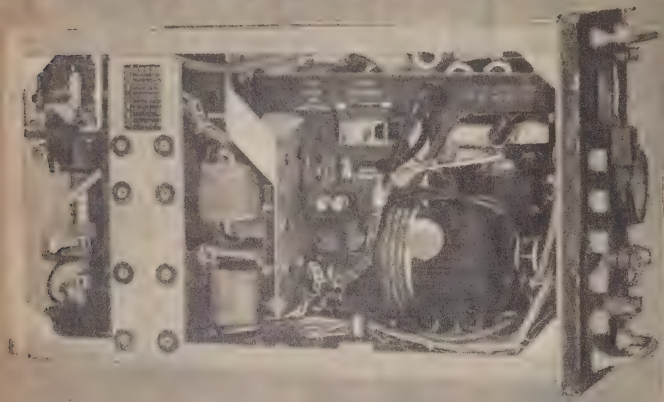

This is an interior view of the RT 181/APG-30 radar unit, currently available through a number of disposals sources, which we modified for 10,000 Mc amateur band operation. A description of the relevant portions is given in this article, the modifications appearing next month.

by Alan Nutt

Further to our discussion last month on the components used in microwave circuitry, some additional notes are given on waveguides and cavities. In addition, we discuss some practical aspects of antenna systems and consider in general terms one of the currently available microwave radar units with a view to modifying it for operation in the 10,000 Mc. amateur band.

IN a conventional two-wire or co-axial transmission line, it is possible to measure directly the voltage and current amplitude at various points along the line. This is not the case with a waveguide, however, as the current and voltage are not confined to a single conductor or pair of conductors but appear as a charge on the inner walls of the waveguide.

It is possible, nevertheless, to measure the effect of these charges or, more correctly, the effect of the electric and magnetic fields created by these charges. This may be done fairly simply by the insertion of a probe or loop into the waveguide.

PROBE INSERTION

A probe must be inserted so that it lies parallel to the electric field, in which position the greatest voltage will be induced in it, while a loop must be arranged so that it is cut by the magnetic flux and have the largest possible current induced.

If these conditions are satisfied, the voltage and current so generated in the probe and loop may be measured by conventional means and the results will then give an accurate picture of the instantaneous charges existing within the cavity or waveguide.

In a similar way to which energy may be taken from a waveguide, energy may be initially coupled into it, if the probe or loop are energised from an external source.

The position of the probe or loop in the wall of the cavity is influenced by the amount of coupling required and the importance or otherwise of the impedance at the point of insertion.

In the case of a rectangular section waveguide propagating a $TE_{1,0}$ wave maximum coupling from the probe into the guide, or vice versa, will take place if the probe is inserted at the centre of the wide dimension of the guide. Fig. 1a.

CAVITY EXCITATION

This is so because the electric field intensity is maximum at this particular point.

Moving the probe towards either edge will reduce the amount of coupling until it reaches a minimum at the side walls, where the electric field intensity has fallen to zero.

Maximum magnetic coupling to or from the same waveguide is achieved with the coupling loop inserted through the narrow side of the waveguide and so oriented that the plane of the loop is at right angles to the longitudinal axis of the guide, Fig. 1b. Rotating the loop through 90 degrees will reduce the coupling to a minimum, the lines of magnetic flux no longer cutting the wire of the loop.

Not only does the coupling change as the probe or loop is moved with relation to its particular field, but the impedance at the point of insertion changes likewise as the ratio of field intensity changes. From this, it follows that the probe or loop may be correctly terminated or matched into the waveguide if the correct point of insertion is selected.

If a probe is inserted into a waveguide for the purpose of checking the standing-wave ratio or measuring the in-guide wavelength, it is necessary to move the probe along the length of the guide for a distance of two or more wavelengths. Special waveguide sections are normally employed for these measurements having a narrow longitudinal slot cut in the wide face through which a probe may be inserted and moved up and down the line while measurements are being made.

A third method of coupling is sometimes employed, known as slot coupling, Fig. 1c. This method utilises a narrow slot cut in one of the walls of a waveguide or a resonant cavity. Because of its small width, the slot has negligible effect on the operation of the cavity or waveguide.

The presence of the slot will interrupt the flow of current in the walls of the guide or cavity, however, and cause a voltage to be developed across the width of the slot. This, in turn, causes the slot to radiate energy out into space or into another waveguide connected at that point.

MAXIMUM INTENSITY

Alternatively, if a waveguide carrying energy is connected to such a slot in a resonant cavity, the voltage developed across the slot will cause the cavity to be excited in the same way as if a probe was inserted into it.

Standing waves are set up in a waveguide for the same reasons as they occur in a normal transmission line. Impedance mismatches may take place due to sudden discontinuities or irregularities in the waveguide. Open, shorted or incorrectly terminated guides, joining of dissimilar sections, sharp bends, etc., are some of the causes which can give rise to a high SWR.

If two sections of waveguide having different dimensions are to be joined, or if a rectangular section is to be joined to a circular section, it is preferable to employ a tapered section as an intermediary rather than rely on a butt joint. If the taper section is made more than two or three wavelengths long, very little reflection will take place at the junction and the SWR will be low.

A second method of joining waveguides, where a machined fit is not possible or practical, utilises a choke coupling section. This device consists of a very short length of waveguide, around the periphery of which, at each end, is a narrow channel or trough. Alternatively, the waveguide itself may employ a flange having the trough turned in it.

The trough is made a quarter wavelength deep at the operating frequency and, being short-circuited at its lower end, presents a high impedance across its open end. This very effectively prevents energy radiating from the join in the manner of a slot coupling and also assists in preventing undesired reflections

ack down the guide.

Where possible, sharp right-angle bends n waveguides should be avoided, smooth urves being preferable.

One further point needs to be covered oncerning waveguides and this deals vith the introduction of constrictions into he waveguides for the purpose of im- edance matching.

If a thin metal diaphragm is placed cross portion of the narrow dimension f a waveguide operating in the $TE_{1,0}$ node, part of the electrostatic field will e short-circuited and the constriction vill appear to be an inductive reactance.

If the diaphragm is placed across the vider dimension, it will appear as a apacitive reactance. By suitably pro- portioning the two types of constriction t is possible to provide an impedance natch and prevent any reflections back long the guide. (Fig. 2.)

Assuming that a certain termination xhibits a capacitive reactance with a onsequent capacitive SWR, an inductive onstriction may be employed across the waveguide a half-wavelength from the termination. Suitably proportioned, this constriction will itself set up a standing wave but of opposite phase to that caused by the termination. The two standing waves will cancel and the source end of the waveguide will receive no reflected energy.

It was mentioned, in passing, last month that the resonant frequency of a cavity could be altered over small limits without the necessity of changing its physical dimensions. This is accomplished by inserting a metal slug into the cavity in such a way that it interrupts some of the magnetic or electric lines of force.

CAVITY RESONANCE

If the slug is so positioned that it intercepts more magnetic (or H) lines than electric (or E) lines, the resonant frequency of the cavity will be raised. On the other hand, if the slug intercepts more E lines than H lines the resonant frequency will be lowered.

This is analogous to the insertion of a brass slug into the magnetic field of a coil used in a conventional tuned circuit. This, we know, lowers the inductance and raises the resonant frequency. Lines of force are used up generating eddy currents in the slug and hence are not available for the generation of a back EMF in the coil.

By the same analogy, inserting a metal disc between the plates of a capacitor would reduce the dimensions of the electric field and this, in turn, would result in an increase in capacitance. The net result would be a lowering of the resonant frequency of the tuned circuit. Fig. 3 shows how the slugs are positioned in a Rhumbatron type cavity to have these desired effects.

Passing on now to antenna systems, it is in this field that considerable variety is encountered, due, for the most part, to the different applications in which microwave equipment is employed. Type of service, distance to be covered, terrain, etc., all play a part in determining the particular antenna system to be used.

Over very short distances, both the transmitter and receiver waveguide may be left open with no termination connected. Considerable spreading of the signal will occur with this method and only a small amount of the radiated energy will find its way into the receiver waveguide.

IMPEDANCE CHANGES

At the same time, due to the sudden impedance change occurring at the open end, strong signal reflections will set up a high SWR with attendant loss in the waveguides.

It is normally desirable, therefore, to use a flared end section on both the transmitter and receiver waveguides. These flared or horn sections have the same effect as the tapered joining sections mentioned earlier, in that they permit a more gradual impedance change with a consequent reduction in the SWR.

The horn antenna will also add some directivity to the system, because the signal divergence will be less severe, thereby permitting increased operating distance and signal strength.

By far the most common antenna system employed at microwavelengths is a parabolic reflector used in conjunction with one of several different feed arrangements. Open or flared waveguide

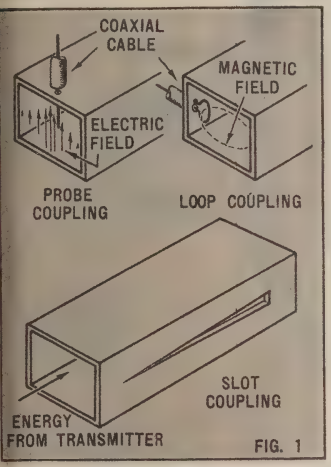

FIG. 1

Indicating three methods by which energy may be coupled into or out of a waveguide or resonant cavity. The particular method chosen depends upon the application.

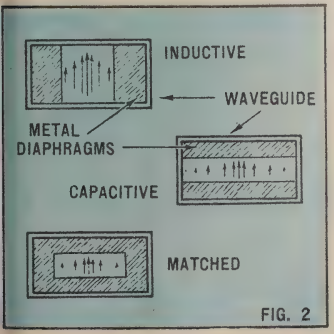

FIG. 2

By the use of thin metal diaphragms placed in the waveguide it is possible to make sections of the guide exhibit reactive properties. By this method it is possible to improve the impedance match between a waveguide and a load or termination to which it is connected.

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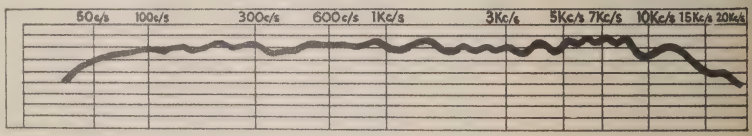

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is often used or a half-wave dipole and small reflector may be excited from the waveguide and re-radiate into the parabolic dish.

The parabolic reflector is the most commonly used because it is the only reflecting shape with which it is possible to locate a point of exact focus. In fact, an exact point of focus is not strictly necessary, owing to the fact that the radiating or receiving source, i.e., waveguide, dipole or horn, is not a mere spot but has some definite size and some aberration of the focal point is therefore permissible.

PARALLEL BEAM

It remains true none the less, that the the parabolic reflector will permit the nearest practical approach to a parallel beam, as compared with other reflector shapes. (Fig. 4.)

If a spherical reflector is used at the transmitter, Fig. 5, not only will the beam be widely divergent, but cancellation and reinforcing effects will be observed. These occur because radiation from the point source marked "F" to the reflecting surface of the spheroid must, after reflection, pass back through the point of origin. The net result will depend on the distance the wave travels before it passes back through the source point but may well range from complete reinforcing to complete cancellation.

The paraboloid reflector overcomes this problem to a large degree and, assuming the feed source to be at the focal point, the reflected beam should theoretically be perfectly parallel. In practice, however, it is never possible to obtain anything but a conical beam from a parabolic reflector, due to slight inaccuracies in its shape but more particularly because of diffraction phenomena.

This phenomenon causes a spreading of the reflected energy in excess of the theoretical limits imposed by geometrical optics. A similar phenomenon is observed with the reflection of light waves but because microwaves are very long compared to light waves, the effect is more pronounced.

DIFFRACTION EFFECTS

Because of this spreading effect of the radio waves around the edge of even a perfect parabolic reflector, the emitted beam can never keep the same cross-sectional area as the antenna from which it was emitted but will always diverge to some extent. Naturally, as the paraboloid is made larger, so the edges of the dish will be further and further away from the source point and the diffraction effects will become less evident.

This fact is of such importance in determining the narrowness of an emitted beam that it is really the only one which need be considered. If the shape of the dish and the selection of the feed point are reasonably well selected, then the width of the emitted beam will depend almost entirely on the size of the dish.

It is sometimes advantageous to increase the distance of the feed point 10 or 20 per cent beyond the focal distance and the convergent effect thereby obtained may then be used to offset some of the divergent effect inherent in the system.

Fig. 6 shows the field strength pattern of a typical parabolic antenna plotted on polar co-ordinates. The points marked 'X' and 'Y' are known as the half-power points and the angle included between the two lines drawn from the source to these two points is commonly considered to be a measure of the width of the beam.

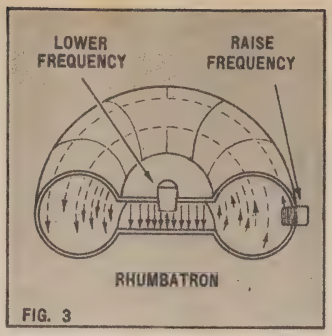

FIG. 3

The resonant frequency of a cavity may be altered over a limited range by means of metal slugs inserted through the cavity wall. The position of the slugs in relation to the internal fields determines what effect they will have on the frequency.

As mentioned, the diameter of the reflecting dish is the main determining factor in calculating the width of the emitted beam. A simple rule of thumb, which contains a strange mixture of units but nevertheless works in practice, is that the half power width of a beam radiated from a dish having a diameter of D feet at a wavelength of L centimetres, is approximately 2L/D degrees.

Thus a dish having a diameter of 3 feet and radiating a signal of 3 centimetres wavelength would produce a half-power beam width of 2 degrees.

So much then for the general theory. We have hardly scratched the surface but sufficient has been said, we feel, to permit a logical appraisal of microwave equipment which may be on hand. Further to this end, then, we will consider in some detail one of the microwave radar units which are currently available through disposal sources.

Originally designed as air-borne radar equipment, these units, designated

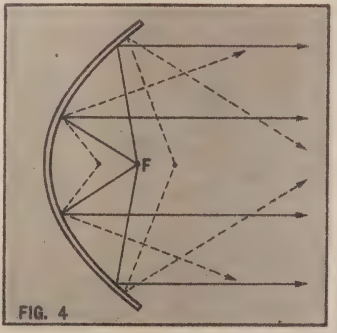

FIG. 4

The parabolic reflector is the most commonly used at microwave lengths. By placing the feed-source at the focal point it is possible to approach the ideal condition of a parallel radiated beam. Other factors must be considered, however, and these are discussed in the text.

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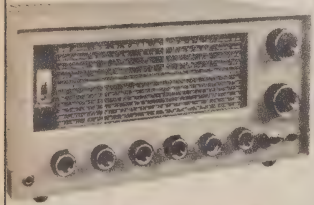

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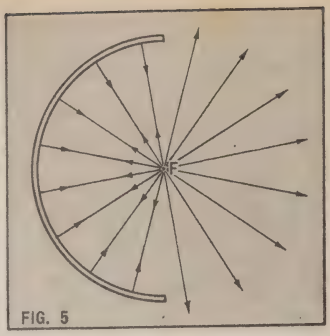


A spherical reflector can cause considerable cancellation effects due to the reflected wave passing back through the point of origin. Unless the phasing is carefully adjusted, the overall performance may be considerably impaired.

RT181/APG-30, are ideally suited for modification as FM transceivers in the X band, which includes the 10,000 Mc amateur band.

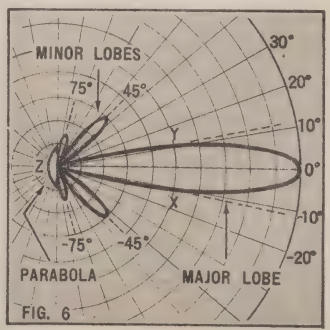
Basically, the unit contains a microwave "front end" consisting of a multicavity magnetron which functions as a tuned oscillator to provide the high level transmitted signal, and a mixer oscillator section employing a silicon crystal diode mixer and reflex klystron as the local oscillator. An additional crystal diode is used to provide signal for an AFC unit.

Following the microwave "front end" is a four-stage IF strip, tuned to 30 Mc, an AFC assembly to control the local oscillator frequency and, in addition, a number of other useful miniature valves which may be put to good use in the construction of the transceiver.

Numerous capacitors and resistors complete the complement, the whole assembly being house in a neat 9in x 6in x 16in case. Indeed, many of these units have been purchased for the parts alone, the front end 'hardware' being simply discarded.

It is unfortunate that all the transformers for the inbuilt power supply are designed for high frequency operation rather than 50 cycles, but even these may find a use in some audio applications if one is prepared to sit down and spend some time checking turns ratios with an audio generator and a VTVM.

The magnetron is a twelve cavity, transit time type, designated 2J42 and will supply a peak pulse output of 8kW at a frequency in the vicinity of 9,400 Mcs. The majority of the units have had the magnetrons removed before sale, although this is of little consequence, little use being found for them apart from the associated magnet.



The radiation pattern of a parabolic antenna, plotted on polar co-ordinates, is indicated above. The included angle, XZY, is commonly taken as the beam width and, in a practical system at 10,000 Mcs., may approach one degree or less.

LOCAL OSCILLATOR

The local oscillator is a 2K25 reflex klystron with provision for coarse mechanical tuning by means of adjustable struts on one side of the tube. Turning the adjustment screw in an anti-clockwise direction stretches the cavity and raises the frequency.

This may seem rather paradoxical at first, but an examination of the internal structure diagram will show the reason for the upward shift in frequency. Stretching the cavity has the effect of increasing the "inductance" but, in the process, the repeller electrode is moved further away from the bottom of the cavity, thereby considerably reducing the "capacitance."

The decrease in capacitance far outweighs the increase in inductance, the net result being an increase in the natural resonant frequency of the cavity.

This mechanical tuning permits a shift in operating frequency over about 800 Mcs., with an upper limit in the vicinity of 9,900 Mcs. Some of the earlier vintage klystrons in the same series had a more limited tuning range with a lower upper limit and were consequently not so easily adaptable to operation within the amateur band.

The mixer and AFC crystal diodes are both 1N23B types, although some units may have a 1N21B in the AFC position. Both these diodes have a very high self-resonance which makes them eminently suitable for use at these frequencies.

UNIT OPERATION

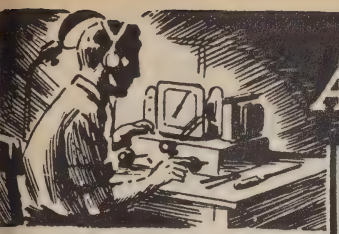
The remaining two items making up the front end are the transmit-receive (TR) tube and cavity, type 1B24A and the anti-transmit-receive switch, type 6038. To understand the function of these components, it is necessary to know in general terms how the unit functions as a whole.

The magnetron is triggered electronically so that it sends out a continuous string of very short duration pulses, usually around 1 microsecond long. The pulse repetition rate may be varied depending on the radar range but, in this instance, we will assume it to be 1,000 per second. It may be seen therefore that the magnetron is actually operative for only one millisecond every second.

During the relatively long interval between transmitted pulses, the magnetron is inoperative and the system is in a condition to receive reflected pulses from distant objects.

These incoming pulses, which have approximately the same frequency as the original transmitted pulse, due to Doppler shift, pass down the waveguide from the antenna, through the TR switch cavity and into the mixer crystal. Here they are combined with a signal from the local oscillator which differs in frequency from the magnetron by

(Continued on Page 75)



A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A VARIABLE POWER SUPPLY FOR THE WORKBENCH

From a reader in Woollahra we have received the following description of a variable power supply which he has constructed.

HOW often have you built up a piece of radio equipment and then looked around for suitable high tension and filament voltages with which to test it?

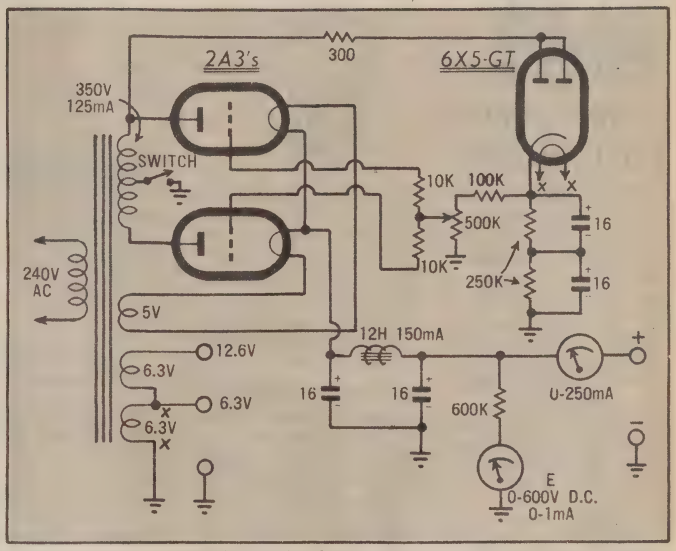
Here is a handy power supply unit which provides either 6.3 or 12.6 volts A.C. and filtered B-plus variable from 200 to 400 volts at up to 125 milliamps.

Housed in a standard 13 by 9-inch R. TV & H. instrument case, the supply consists of two 2A3 valves wired as half-wave rectifiers, the pair making up a full-wave rectifier system. DC current is taken conventionally from their common heater-cathodes, to a capacitor input filter.

CONTROL BIAS

Since the 2A3's are triodes, the current flow through them can be controlled by varying their grid bias. The cathodes of these valves are at a high positive voltage with respect to chassis so the bias voltage must also be likewise. This is accomplished by rectifying some of the high tension secondary voltage with a 6X5, the plates of which are commoned to form a half wave restifier, and feeding a selected amount to the 2A3 grids via a potentiometer.

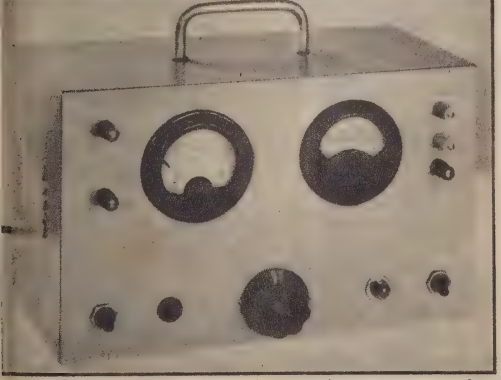
The 2A3 heaters require 2.5 volts A.C., so the two in series operate from a 5-volt winding. The 6X5 is supplied from a 6.3-volt winding. The transformer in this unit is rated at 350 volts a side at 125 milliamps, and the choke is capable of passing 150 mA. Measured voltage output with no load ranges from just under 100 volts DC to 400 volts DC.



The circuit is relatively simple, being more or less conventional power supply using two triodes as half wave rectifiers. An adjustable voltage applied to the grids is used to control the output.

Two meters on the front panel allow both voltage output and current drain to be monitored while the variable supply is actually in use. Multiplying one by the other and dividing by a thousand immediately gives the power demand in watts.

Any pair of triodes capable of handling the voltage and currents may be substituted for the 2A3's, provided suitable filament windings are available on your transformer.



At left is the complete supply housed in a neat metal case. At right is a rear view of the chassis, showing the general layout. The power transformer is on the right, choke on the left, and the external meter multiplier in front of the choke.

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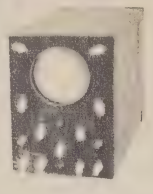

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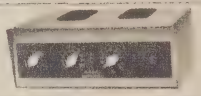

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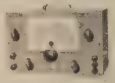

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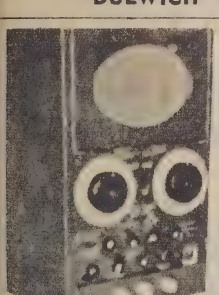

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24v.	250v. 100mA.	New	£2 0 0
12v.	235v. 50mA		£2 15 0
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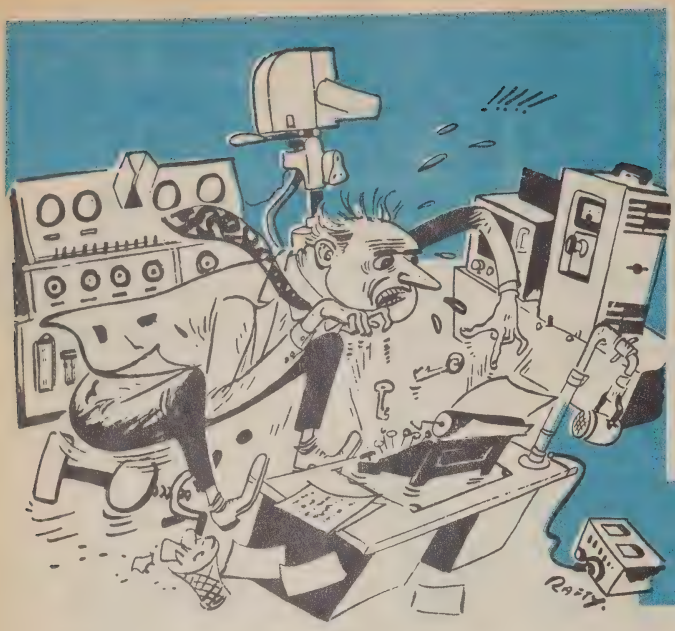

Let's Buy An Argument

ABOUT OUR 1961 TV RECEIVER

Hard on the heels of our last article, criticising a feature in an overseas magazine, came the letter which you see opposite—trenchantly criticising one of our own designs. Are we guilty or are we not? We'll do our best to answer the "charges" and leave you to reach a verdict.

By Neville Williams

NATURALLY enough, it would be a good idea to read the charges first, then see what we have to say on the subject.

The charge is that "Radio, Television and Hobbies" in general, and Alan Nutt in particular has been negligent in designing the 1961 Television Receiver.

As an illustration of this "negligence," attention is drawn to our use of unshielded coils and sections in the I.F. channel. Our correspondent says that they reminded him of his own early and unsuccessful efforts in television set construction. He apparently ran into trouble, therefore our set must, of necessity, exhibit the same failings.

COMPLETE SCREENING

His summing-up: "Satisfactory results are obtained only after completely screening each stage with a screen the full depth of the chassis, across each I.F. valve socket."

By way of rejoinder, I cannot resist the remark that the suggested technique of shielding I.F. stages in this manner reminds me very strongly of a variety of British receivers imported into Australia, in the early days of television, and of close copies made therefrom, about the same time.

Significantly, perhaps, the technique has been dropped, largely if not completely, by Australian manufacturers.

But let's get one point clear. In examining the situation, I am not arguing against shielding as a general principle, or counselling the general use of unshielded coils and stages. What I say relates purely to the problem on hand —the design of I.F. amplifier strips for use in competitively priced home television receivers.

In the early days of local television, the "standard" design approach was to use a 4-stage I.F. amplifier system, often with the individual stages enclosed in deep shield compartments. It was reckoned that four stages could be relied upon to provide all the gain that would ever be required, as well as being capable of alignment to something very close to the ideal.

But, of course, four stages, using high-transconductance valves, can present stability problems and extensive shielding appeared to be necessary.

But a fully shielded, four-stage I.F. amplifier channel is a rather expensive item to produce and, because of limited accessibility, not the easiest thing in the world to service. Quite naturally, therefore, attention was very soon given to reducing cost and improving accessibility.

The first R., TV and H. television receiver used a four-stage I.F. amplifier channel, built on a sub-chassis, with no inter-stage partitions but with cans over the individual transformers. It gave all the sensitivity that could be required in this section of the receiver and could be aligned to a copy-book kind of response curve.

However, by the time we came to face up to the 1959 TV set, there was strong pressure from all and sundry in the trade . . . try to get the price down so we can sell it!

The answer seemed to be tied up, in part, with a new 3-stage I.F. amplifier strip then being developed by Messrs R. W. Steane, makers of Q-Plus components.

But three stages? Would such a set be a proposition in the field, under a variety of signal level conditions? We had exactly the same reservations, at the time, as many of the major manufacturers, who were thinking along similar lines and for exactly the same reason.

CAUTION

So, when we ultimately presented the 1959 receiver, we suggested caution before building it for use in known fringe areas and we allowed for possible substitution of the existing 4-stage I.F. strip.

As matters transpired, there was no need for such caution, because the set proved itself well capable in practice of resolving any signal worth looking at. We never did re-run the design with the larger strip incorporated.

But the 3-stage hurdle was not the only one. When the prototype of the new strip came to hand, it had small, completely unshielded I.F. transformers that seemed to invite instability problems. Our reaction was exactly that of our present correspondent.

But the facts could not be denied. The new strip, besides having all the gain that seemed to be necessary, and the ability to produce an acceptable response curve, showed no signs of troublesome regeneration, when aligned for the requisite broadband response. And, of course, the cost saving was very real.

So it was that the 3-stage unshielded I.F. amplifier strip made its debut in the 1959 Television Receiver, over the name of the same person who had "fathered"

the previous designs—your humble servant! Nor have we had any reason since to regret what was then something of an innovation.

Nowadays, it represents quite ordinary design practice.

In building the 1961 receiver, therefore, staff member Alan Nutt used exactly the same I.F. strip that had been introduced in 1959 and which had remained current and satisfactory over the intervening two years.

The accusation that the use of unshielded I.F. transformers is a recent lapse cannot therefore be sustained. Nor do events suggest that the performance available from the strip is unsatisfactory.

Our correspondent's attempt to bolster his case by reference to the screening over the detector is also astray. The prime purpose of this screening is to limit radiation of harmonics from the detector wiring back into the front end —a common cause of interference patterns on the screen.

NORMAL PRECAUTIONS

To be sure, we had something to say in the article about instability in the I.F. channel, as a warning to those who may have preferred to wire their own. The whole success of a simple I.F. channel of this type depends on proper orientation of the components and wiring, and in the use of suitable bypass capacitors.

But one can hardly condemn a unit because it might be unsatisfactory if incorrectly constructed—especially when the correct way is also the easy way!

In the second portion of the letter, our correspondent is perturbed by our apparent vacillation on the subject of the video DC component but he goes into a complete flap about the method of DC restoration adopted. The method is "clumsy," a "hazard" and represents "dangerous practice," he says.

We'll come back to all this presently but, first, a word about the video DC component.

Back in 1957 this was a hotly debated subject, as we freely admitted at the time.

One group, largely reflecting the European viewpoint, held solidly that the reproduced picture should contain the full DC component, running the whole gamut from predominant white to predominant black according to the content of the original scene. In this group were those who held for full retention of the original DC component, while others preferred the principle of synthesising or "restoring" it.

OPPISITE VIEW

A second major group, largely reflecting the American viewpoint, claimed that retention of or even restoration of DC made the receiver too tricky to tune, by reason of the interaction which occurred between the Brightness, Contrast and Tuning controls. Further, that the reproduced picture would be subject to drastic and disturbing changes in brightness, unless station monitoring anticipated changes in average intensity from the wide variety of subject matter involved by intercutting studio scenes, films and slides.

At the time, opinion was pretty equally divided, with the quality of Australian station picture monitoring a largely unproven factor. Having respect to this and to the technical problems involved, we decided to take the easy road and use straight capacitive coupling, with no attempt at DC retention or restoration. And we followed this practice in all the early designs.

However, for the sake of those who had strong feelings in the matter, we published a suggested DC restoration circuit which we had proved to be both versatile and efficient. The work on it had been done in a set built by our present Technical Editor. Many readers subsequently added the circuit to their own receivers and reported enthusiastically on its behaviour.

By the time our 1959 receiver was under development, thinking on the video DC question had begun to crystallise away from the AC coupling method. Station monitoring had proved to be much better than early gloomy forecasts and the public, meanwhile, was becoming better educated in the matter of tuning television receivers.

In line with this, we decided to use direct coupling in the video system of the new receiver.

But direct coupling in the video system doesn't necessarily mean full retention of the DC component.

To retain the DC component in full, it is necessary also to use an AGC system keyed to the blanking or synch. pulse height and to peg the screen of the video amplifier stage (or stages).

For reasons of simplicity, we were prepared to do neither of these things in the 1959 receiver, so that the DC component was retained only in part. It so happened, however, that it represented an order of compromise which had support in other prominent circles.

Facing up to our latest design, the question of the DC component naturally came up for fresh consideration. Would we have purely AC coupling, partial retention of the DC, full retention with all its implications on design complexity or what?

But what about the old DC restoration circuit which many of our readers had been using for years? A circuit which gave the builder free choice of anything

DOESN'T LIKE UNSHIELDED COILS

Dear Sir,

Down through the years, we "not so old, old timers" have come to recognise "Radio Television & Hobbies" as a highly informative and valuable publication, electronically speaking. Nevertheless, after reading the first article on the "1961 Television Receiver" in July, 1961 issue, I could not help but feel that perhaps some of the precautions and pains taken in earlier designs had been overlooked.

The "open air" I.F. transformers were sadly reminiscent of my early attempts at TV. Satisfactory results are obtained only after completely screening each stage with a screen the full depth of the chassis across each I.F. valve socket.

The reference in the article to screening the detector leads one to believe that instability can be expected from this design.

After reading the second article in the August, 1961 issue, I feel that you would be well advised to publish with as little delay as possible, a correction to the circuit diagram before too many claims for damaged picture tubes are received by your office from readers building a receiver from this circuit.

A very dangerous practice has been adopted by Mr Nutt in his method of connecting the DC restorer to the picture tube. If DC restoring is necessary (we were assured back in 1957 that it is not, though I feel it is an improvement) why jeopardise the life of the picture tube by a clumsy addition of a triode which introduces a hazard, not in the best interest of long picture tube life?

I refer to the method of connecting the picture tube grid to the plate of the DC restorer triode.

If we look at the circuit concerned with the brightness control, we find that the maximum voltage we can put on the picture tube cathode is about 160 volts. Now look at the plate of the DC restorer.

While it is drawing current, a voltage drop will exist across the 100K plate resistor but, should the triode cease to draw current or if it is removed, no voltage drop will exist. The full B-plus 250 volts will be fed to the picture tube grid, making it 80 volts positive with respect to the cathode. This should dispatch the picture tube very rapidly.

This precaution concerning the connecting of the C.R.T. grid to plate circuit is fully covered in "Radio Craft" for January, 1940. I therefore, once again urge you to omit this triode DC restorer. Use a 12BY7 video amp. and to restore the DC component, place a 470K resistor across the .47 coupling condenser from video amplifier plate to C.R.T. cathode.

Yours faithfully, R. T., (Auckland. N.Z.).

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between full AC coupling and full DC restoration? A circuit which could use the triode section of a 6U8, available "free" in the I.F. strip?

Well, as you saw in the circuit, we used the idea—not a new and untried notion but one that had been current for years, without a single adverse repercussion!

Nor do I think the reason for the lack of such repercussion is an accident. If failure of the triode unit did, in fact, impose 250 volts on the picture tube grid, then there would be some cause for alarm. No picture tube would like to have plus 80 volts imposed between its grid and cathode.

The fact is, of course, that the voltage can be applied to the grid only through a total resistance of 0.115 meg. In the cathode return circuit, there is a further net resistance of well over 0.1 meg., so that the current which could flow through the grid/cathode circuit from an externally applied voltage would be well under a milliamp, with very little voltage across the diode element so formed.

While I wouldn't advise running any tube with this as a permanent condition, it is hardly likely to do any damage during the time it would take someone to realise that something was wrong and to pull the big switch.

But, of course, to the unlikely chance of any serious damage being done, has to be added the further unlikely chance of complete failure of the 6U8 triode!

As our "Serviceman Who Tells" is wont to say on such occasions, "I only wish there could be as little risk of me not winning the lottery!"

Well, there it is. Have the charges been sustained or not? Guilty or not guilty?

CAVITIES, KLYSTRONS PLUMBING . . .

(Continued fromg Page 68)

an amount equal to the IF, which, in this case, is 30 Mcs.

The resultant IF signal is passed on to the IF amplifier and thence to an external detector and visual display unit for monitoring purposes.

The local oscillator power output is usually well in excess of that required by the mixer diodes and, for this reason, the klystron first of all feeds into an attenuator section of waveguide in which portion of the energy is dissipated in a graphite coated strip.

The amount of oscillator injection is regulated by an adjusting screw which varies the size of a slot through which the oscillator energy must pass from the attenuator section into the mixer section.

The transmitter and receiver share the same antenna system and, as it is well-nigh impossible to make a relay which will function satisfactorily at such high speed, an electronic form of antenna switching is employed.

It is essential that the mixer crystal be protected from the high energy pulse from the magnetron as it would only take a few milliwatts to destroy it. This is where the 1B24A TR switch comes into the picture. Its function is to effectively short circuit the waveguide section between the magnetron and the mixer crystal during the transmit period.

(To Be Continued)

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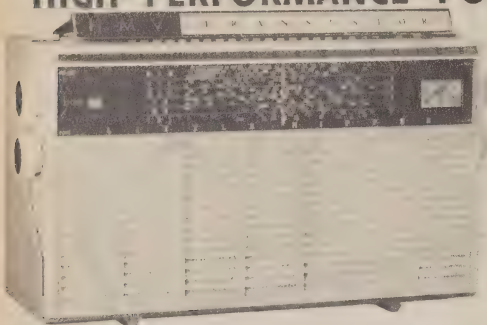


E.M.I. (Australia) Limited recently submitted for review samples of their new "Little Nipper" cordless mantel-cum-transistor portable radios.

Two models are being offered, one a 7-transistor unit featuring an RF stage, and the other a 6-transistor model. They are visually identical and appear in the stylish case shown in the above photograph.

Although the cases appear identical, however, they differ in the plastic material used. The 7-transistor model (designated 14-17) has an impact-proof, flexible case made from "Cycolac," whereas the 6-transistor model has a regular high-impact case.

The 7-transistor model is guaranteed for 3 years against the case breaking, which gives an indication of the impact resistance of the Cycolac plastic material. In a test, the rear of the case was placed on the floor and the tester jumped on it, distorting it quite considerably. Apart from one or two slight scratches due to his shoes, the case was unaffected. Impressive?

Both models are obviously well made and have been carefully designed. They both operate from a standard 9-volt battery, have generous sized speakers and incorporate tone controls. Dial lamps are fitted to both, but push buttons for the dial lamps ensure that battery consumption is kept to a minimum.

Both models have ferrite rod aerials, the 7-transistor model being fitted with a special large diameter rod for increased performance.

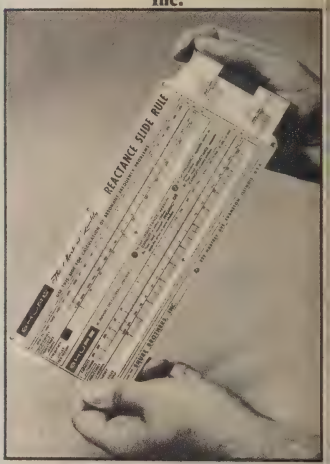
On the performance side, both models rate particularly well. The 7-transistor model has added sensitivity and signal-to-noise ratio, as one would expect. With it, country stations are "local listening" quality throughout the day, and night listening under good conditions will log in many overseas broadcast station—N.Z., Hawaii, etc.

Surprisingly enough, the 6-transistor set is not a great deal behind in performance and represents excellent 6-transistor value.

Quoted prices for the sets are 25 gns. for the 6-transistor set and 29 gns. for the 7-transistor set—both retail figures.

NEW REACTANCE SLIDE-RULE FROM AUDIO ENGINEERS

Pictured below is an interesting reactance slide rule for engineering problems involving resonant frequency calculations, etc., manufactured by the American firm of Shure Brothers Inc.



THE slide rule was supplied for examination and review by Audio Engineers Pty. Ltd. of 422-4 Kent Street, Sydney, who advise that they are sole Australian representatives for the Shure firm. Other products in the Shure line include microphones, pickup cartridges, tape heads and pickup arms. (At present, purchasers of Shure pickup cartridges are offered a free "special pressing" long-play record—a limited offer only however.)

Mechanically, the reactance slide rule is constructed from high-grade cardboard—which will naturally call for careful handling. Considering its modest cost, this may be a small point, but some folk may prefer a more substantial material.

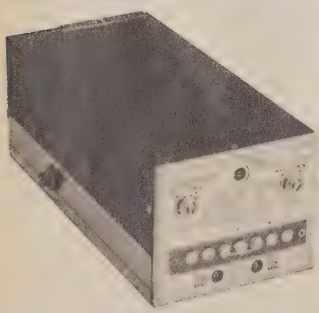
Scales on the rule enable the user to calculate resonant frequency problems at both audio and RF, capacitive and inductive reactances, coil "Q's", and dissipation factor.

The scales are printed in clear, easy-to-read figures which allow convenient operation. Sufficient instructions are given on the rule itself to enable most operations to be performed, but full details are given in a small booklet supplied with each rule.

The price of the rule is quoted as £1, which includes tax. (List price.) Trade inquiries on this and other Shure products are invited. (J.R.)

TV DISTRIBUTION AMPLIFIER

Most modern blocks of flats and home units employ a single antenna for all TV sets in the building. Aesthetically, this is most desirable, but it does mean that some form of booster must be used to compensate for line losses, etc. This new distribution amplifier recently released by Channel Master Pty. Ltd. should be of much interest to all engaged in the installation of such antenna systems, as it is capable of driving up to 40 TV sets from the one TV antenna.



AS can be seen from the above illustration the unit is attractively packaged even though it will normally be mounted in some out-of-the-way position. A perforated metal cover provides for ventilation of its 6 valves and inbuilt power supply. The two preset controls visible on the front panel allow for individual control of high and low band gain. The range of control is from 6 to 35 dB on each channel.

Provision has been made to match separate high and low band antennas of either 72 or 300 ohms impedance or an all band autenna having either 72 or 300 ohms impedance. A single 72-ohm output socket is provided as 300-ohm ribbon would obviously be impractical for feeding a large number of distribution points. A complementary range of splitter boxes and terminal outlets is available for use with the unit. This system is claimed to give a much greater flexibility in installation layout than a system where a multiple outlet is incorporated in the amplifier proper.

The minimum input required to produce a viewable picture at the various distribution points is 50 microvolts and, for completely snow-free pictures, it is 500 microvolts. Maximum undistorted output is given as 100 millivolts. The noise figure on the low band is 6db and on the high band 7.5db. Mains power consumption is 35 watts maximum.

Standard production alignment procedure gives 35db gain on channels 2, 7, 8 and 9. Where required, the unit can be factory aligned to give 25db gain over all channels or 25db over all low band channels and 35db on any adjacent three high band channels. Alternatively, 35db can be obtained on any one low band channel and 25db over all high band channels.

Further inquiries should be directed to Channel Master Pty. Ltd., of Pittwater Road, Brookvale, or to their agents in all capital cities. Retail price of the unit is given as £68/10/.

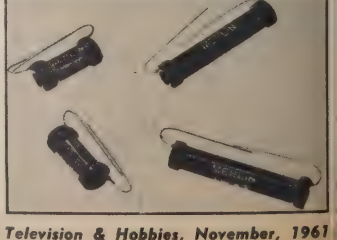
TROPIC-PROOF W.W.RESISTORS

PICTURED below are samples, recently submitted, of the large range of "Merlin" Tropic Proof wire-wound resistors made by the Victorian Resistor Co. Pty. Ltd., 847 Nepean Highway, Moorabbin, Victoria.

The resistors are available in five dissipation ratings, namely, 1, 3, 5, 10 and 20 watts. Tolerances normally are 5 per cent, but 1 per cent types are available. For values below 15 ohms only 10 per cent tolerance is available. The maximum resistance available in the three large sizes is 150,000 ohms, with the 3-watt size having an upper limit of 7,500 ohms. The 1-watt size is available in values from 10 ohms to 2,400 ohms only. Former sizes are quite modest on all sizes. The three smallest sizes have wire lead connections, and the 10 and 20 watt sizes solder lug connections.

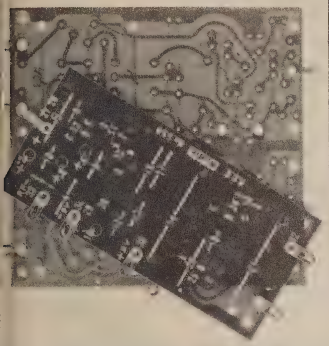
Silver soldering techniques, metal-to-ceramic heat bonding, and a multi-coat proofing enamel render the units very stable under all forseeable conditions. Permissible temperature rise in operation (ambient plus dissipation) is to 160 degrees C., which generally requires the 20-watt size to be mounted on a six square inch heat sink.

For higher temperature operation, the "Hi-Temp" line of power resistors are recommended. These are manufactured by the same firm and are identical to the previous type in all features except temperature rating, being rated for operation up to 250 degrees C. total.—J.R.



NEW PRINTED BOARDS FROM R.C.S.

Designed to replace the older type standard audio board used in many of our past circuits, this new printed board from R.C.S. Radio Pty. Ltd., features a considerable reduction in size and weight.



THE boards are available in either single or dual units, suitable for mono or stereo applications. The only changes necessary to modify the board for 1-watt output instead of the normal 500 mW, are a new output transformer and different output stage transistors.

Transformer mounting is designed for the new Ferguson types, which may be directly soldered in to the boards without the necessity of worrying about colour coding or wire cleaning.

G.R.D. ANNOUNCE PRICE CHANGES

G.R.D. Instruments Pty. Ltd., agents for "Labcraft" and "All Balance" equipment, announced price changes on September 26. Unfortunately, their October advertisement showing the old prices was already in print at this date. All trade houses were immediately circularised with the new prices, and apologies are offered for any inconvenience due to the subsequent appearance of out-of-date prices in the October issue.

Some of the new retail prices are as follows:

LABCRAFT TURNTABLES

Type 573V with head and stereo diamond £27/18/9.

Type 573V with head and two sapphires, £24/5/6.

Type 605 less arm, £24/1/0.

Type 605, "All Balance" arm, no cartridge, £39/18/3.

HIGH-SLOPE I.F. AMP. PENTODE

RECENTLY released by AWV is this sharp cut-off pentode of the 7-pin miniature type to be known as the 6EW6. Designed for use in TV IF amplifiers in the order of 40Mc, the 6EW6 features controlled plate-current cut-off and high transconductance (14,000 micromhos), combined with low capacitance values.

Separate base pins are provided for the grid No. 3 and the cathode. This arrangement permits the use of an unbypassed cathode resistor to minimise changes in input conductance and input capacitance with bias, without causing oscillation, which may otherwise result if grid No. 3 were internally connected to the cathode.

Further information, price, &c., may be obtained from Amalgamated Wireless Valve Co., 47 York St., Sydney.

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TYPE	RETAIL
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600' x 5"	34 3
900' x 5¾"	46 6
1,200' x 7"	56 9
LONG PLAY—LGS 35:	
210' x 3"	15 0
600' x 4¼"	34 3
900' x 5"	46 6
1,200' x 5¾"	56 9
1,800' x 7"	77 0
DOUBLE PLAY—LGS 26:	
300' x 3"	1 2 9
600' x 4"	1 17 6
1,200' x 5"	3 2 0
1,800' x 5¾"	4 4 9
2,400' x 7"	5 4 0

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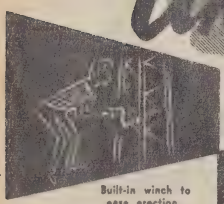

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Porta-tower in travelling position.

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No drilling of vehicle roof is required.

Available in heights of 65ft and 50ft.

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TECHNICAL BOOK REVIEW

ABC's OF TAPE RECORDING by Norman H. Crowhurst, published by Howard W. Sams and Co. Inc., Soft cover, 96 pages, 5½ inches by 8¼ inches.

Mr Crowhurst, a leading authority and widely accepted author in audio and high-fidelity, has used his unusual talents to produce this most practical book on tape recording with an aim towards assisting the layman in the many aspects of his subject.

In chapter one, the reader learns of the fundamentals of tape recorders, how it is possible to put sounds on tape and relay them, the function of record, playback and erase heads, magnetic biasing and controls. The second chapter explains the essential points which must be considered when purchasing a recorder either for a particular use or for general purpose.

In chapter three and four, Mr Crowhurst continues, in layman's terms, to discuss how to use a tape recorder for best results and describes a number of specific applications for tape recorders. Some of the headings are Recording without a microphone — Portable tape recorders — Tape letters.

The final two chapters discuss the many practical and advanced functions the tape recorder can perform. A glossary of commonly used terms is also included. Our copy was received direct from the publishers and the Australian price is not yet available. (J.D.)

★ ★ ★

SEMI-CONDUCTORS AND TRANSISTORS, one of the Electronic Technology Series edited by Alexander Schure, Ph. D., Ed. Soft cover, 140 pages, 5½ inches by 8¼ inches. Another John F. Rider Publication.

The intent of this book is to present, discuss and evaluate the important ideas relating to an understanding of the theory and characteristics of semiconductors and transistors. The mathematical analyses are simple, but the treatments are sufficiently extensive to permit the reader to develop full comprehension of the relevant theory.

Specific attention is given firstly to atomic structure of materials, the quantum theory, the conductor, insulator and semi-conductor, hole conduction and donor and acceptor impurities.

The second chapter discusses semiconductor rectifier action, the PN junction under equilibrium, reverse bias and forward bias conditions and diode operation, while chapter three gives special attention to the extension of PN junction theory into the transistor. Also discussed is a comparison of the basic transistor and valve circuitry.

Chapter four discusses common transistor symbols and characteristics, drawing the load line, establishing the quiescent point of operation. Finally, the last chapter deals with the parameters and elements of design relating to voltage, current and power gain.

Through these and other detailed topics, a foundation is provided upon which more advanced concepts can be built. Review questions are included at the end of each chapter to help the reader determine his comprehension of the material previously presented.

Our copy was received direct from the publisher but it is hoped that this extremely well compiled book will be available through local booksellers in the very near future. (J.D.)

★ ★ ★

FILTERS AND ATTENUATORS, by Alexander Schure, Ph. D., Ed.D. Soft cover, 96 pages, 8½ x 5½ inches. Published by John F. Rider Inc., 116 West 14th Street, New York, New York.

This books deals with the major factors and new techniques in filters and attenuators. The problems inherent in this field are discussed fully, step-by-step, as a technician would encounter them on the job.

Detailed attention is given to the general characteristics of low-pass filters, choke-input filter systems, capacitor-input filter systems, tuned low-pass filters and cancellation filters.

Attenuators and equalisers are discussed, ranging from definitions and examples of fixed attenuators through amplitude equalisers, phase equalisers and resistance pads, noting their types and design.

The text is highly pictorialised by means of graphs and circuit diagrams, while numerical examples and solutions help make the mathematical presentation very clear.

Review questions are included after each chapter so that the student may test himself and a complete alphabetical index occupies the last three pages of the book.

Our copy came direct from the publisher John F. Rider Inc., but copies should be available on the local market in due course.—(K.W.J.)

★ ★ ★

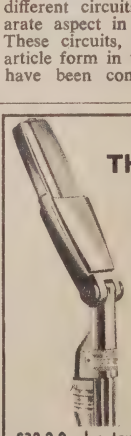
20 SUGGESTED CIRCUITS, by G. A. French. Published by Data Publications Ltd., 57 Maida Vale, London W9. Soft cover, 50 pages, 5½in by 8½in.

This publication contains details of 20 different circuits, each covering a separate aspect in the field of electronics. These circuits, which first appeared in article form in the "Radio Constructor," have been completely revised by the author for presentation in this booklet.

The circuits are too numerous to be listed here, but they include a capacitance bridge, speech-operated switching circuit, transitron inductance meter, production electric timer and a two-stage gramo amplifier.

Explanation of the individual circuits, together with information concerning practical problems likely to be encountered in their construction, appears in the accompanying text.

Our copy came from Electronic Publications (Australia), 11 Cadow Street, Pymble, N.S.W. Price is quoted as 5/6 per copy in Australia.



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LP DISCS AND THE DUST PROBLEM

One of the nagging problems of the LP disc is its affinity for minute particles of dust and fluff, which, in turn, are responsible for many of the "plops" and "clicks" which irk high fidelity enthusiasts. What to do about dust has been the subject of constant debate, ever since the LP disc won public acceptance.

LEST the foregoing introduction should give the wrong impression, we should hasten to add that dust-produced noise with LP records rates as a problem, only when viewed against the possibility of virtually noise-free reproduction; against perfection, in fact.

With the 78 r.p.m. shellac records of a past era, noise due to dust particles was merely a small part of a very considerable whole and in any case, our ideas of tolerable background noise were very different then from what they are now.

NEW APPROACH

From its very inception, the LP disc pressed in vinyl, changed those ideas. As well as the long playing feature and refined engineering in other directions, it demonstrated the possibility of achieving low background noise level as a regular thing.

Since then, every one of us, I guess, has had the pleasure of putting a disc on the table and hearing music out of complete silence. Not all records are as good as that, of course, because, apart from production problems in the disc itself, many contain a significant noise contribution from the Tape Masters from which they come.

But the point is that we have had the experience, not once but many times, and "perfection"—or noise free reproduction—has become a practical standard of reference.

Against this standard, it is galling to play a disc, which we know to have been virtually noise-free, only to hear clicks every now and again, due to the stylus riding over small particles, which have been deposited on the surface.

Unfortunately, there is more to the problem than the mere matter of dust falling on the surface.

It so happens that the plastics which make the best native materials from which to press the discs, also exhibit, by and large, very good electrical insulation properties. When such materials are rubbed against other dry, insulating materials, including record covers and styli, electrons are likely to be transferred from one point to another, leaving surface areas variously charged positive or negative, due to a deficiency or a surplus of free electrons.

If the materials involved exhibit high insulation properties and the atmosphere is dry, there is no way for the charges to equalise and the surface is said to have acquired a static electric charge.

And here the complication arises for, just as a comb or a fountain pen, rubbed against dry clothing, will attract small scraps of paper, so the surface of a LP disc actively attracts pieces of dust and fluff from anywhere in the vicinity.

DIFFICULT PROBLEM

Therefore, while one can do a lot to keep records clean by handling them properly, putting them straight back into their jackets after playing, etc., it is very difficult to beat the dust problem completely by these methods, when the affinity between records and dust is so great.

Record manufacturers have sought, at various times, to defeat the problem at its source by experimenting with materials which exhibit sufficient electrical leakage to allow static electricity on the surface to be dissipated. Unfortunately, it would appear that most of the materials which meet this requirement have had less desirable properties in other respects—notably poorer pressing qualities or a surface texture which itself causes noise of another type.

Thus, while some records have reportedly been released with anti-static properties, there would appear to be little unanimity that the problem has been solved at its source—at least to everyone's satisfaction.

Not surprisingly, a good deal of attention has been given to cleaning cloths and cleaning pads or alternatively to liquids which can be wiped over or sprayed on to the surface of discs. Nor is it surprising, I suppose, that these have been met with both enthusiasm and abuse.

Cloths and pads are primarily mechanical aids, in the sense that they can wipe dust and fluff off the surface, without removing the reason for the dust being there in the first place.

How good a job of wiping they do is another matter, dependant both on the nature of the cloth or pad and the way it is used. It has been pointed out that a smooth cloth which merely polishes the surface of the disc is of dubious value (a) because it does not penetrate the grooves where the troublesome dust lurks and (b) it may as easily push dust off the shoulders into the groove ready for the oncoming stylus!

In this respect, it mightn't be as effective even as the old stand-by of a soft linen handkerchief "moistened" with hot breath.

On a purely mechanical basis, it would appear that the best kind of cloth or pad would be one with a surface "pile" of the right texture to penetrate the grooves and actually lift out the dust particles. But its effectiveness depends largely on running along the grooves, in a spiral motion.

And, of course, it's no use using a pad or a cloth which isn't itself clean, or it will put dirt in, instead of taking it out.

LIQUID PREPARATIONS

Then, of course, there's the question of liquids, which have been sold under many names in many places, generally without a clue as to what they are.

Some liquids would appear to be primarily detergent or soap solutions, designed to dislodge or dissolve "dirt" in any guise. In this respect, they probably have the same order of merit as any undisguised detergent or soap-and-water wash followed—we should fervently hope—with a good rinse under running water.

But, of course, washings or treatment with liquids which subsequently dry, while they may make the record delightfully clean at the time, do nothing to prevent the formation of new static charges—and new deposits of dust.

Non-drying liquids, which have been devised, have been queried on grounds that (a) they provide a greasy medium which holds dirt and (b) they clog the grooves and reduce high frequency response.

While the greatest caution would have to be exercised in selecting non drying electrically conductive liquids, it would appear that at least those prepar

☆

The "Parastat" machine, devised by Cecil E. Watts and marketed in Australia by Simon Gray Pty. Ltd. A few turns of the disc between the special brushes and pads will remove dust which has already collected and render the disc substantially free of static charge effects.

tions which have the backing of major oncerns do not cause the abovemenoned troubles—if used advisedly.

In particular, this means that no more quid should be applied than appears ecessary to reduce static charge effects, s evidenced by observation or active sts.

One such test, mentioned by the journal "Hi-Fi/Stereo," involved holding reated and untreated discs one-inch bove a tray holding free cigarette ash. he efficiency of "anti-static" treatments as made immediately apparent by the mount of ash attracted.

Obviously enough, the application of uantities of liquid in excess of that eeded to achieve the desired result, can nly increase the danger of fouling the rooves. Similarly, too frequent use of ne liquid is open to the same objection. would thus appear to be sound adice to wash a record first with a mild etergent, then rinse and allow to dry. ubsequently, the anti-static liquid can e applied—but sparingly.

REPEAT

If subsequent treatment becomes ecessary at a later date, the safe proedure is to repeat the washing in deterent, to remove vestiges of the former eatment, then start again.

An interesting and alternative approach is represented by the use of deices along the lines of the "Dust-Bug," hich exploits the "clean-as-you-play" rinciple.

Dust Bugs are seen in two forms. One designed to clip directly to the front f ordinary pickup heads, carrying its wn weight, so that it does not materally affect the tracking characteristics f the pickup. It is commonly used with econd playing decks and record hangers.

The second type has its own arm and lowered on to the disc just ahead of ne pickup proper, without making any ontact therewith.

The idea of the Dust-Bug is that a et of nylon bristles picks dust from ne grooves, which is then collected by plush pad, moistened with an antitatic fluid, placed immediately behind ne brush.

Tests have indicated the almost unanny ability of the "Dust-Bug" to find ust where none should exist—on new ecords or on others which have been ashed in pet solutions or wiped on pet loths! Undoubtedly, the devices offer good answer to the problem for those who are prepared to take the little extra trouble that their use involves.

The most elaborate and the most costly anti-static device, as pictured on page 80, is the "Parastat" record cleaning machine, devised by Cecil Watts, of "The Gramophone" fame.

This is rather like an over-sized "Dust-Bug" rigged up with its own mechanism for holding and rotating the disc to be treated. The disc is clamped between two halves of a spindle rotated by the handle on top. Above and below the disc is a nylon brush and a plush pad, the latter moistened with an anti-static fluid.

As the handle is turned, the brush and pad are brought into contact with the faces of the disc. The brush gently scours the grooves, while the pad picks up the dust and also deposits a microscopically thin layer of fluid on the surface of the disc (not in the grooves, the makers claim).

The fluid layer, which is semi-permanent, provides the necessary leakage to dispel static charges and render the disc inert as far as dust particles are concerned.

For the "doubting Thomases," the manufacturers provide a silk cloth with which to rub the discs, and silken threads hanging from the machine which will indicate whether or not the record has been rendered statically inert.

Apparently they are pretty sure of themselves!

QUESTION OF COST

Unfortunately the Parastat is a pretty expensive piece of equipment and likely to appeal only to those to whom the price would not represent a major outlay. Against this, the "Dust Bug" is priced to suit the average kind of pocket and should do a good job for those who are prepared to take the little extra trouble involved by its use.

But cloths, pads, liquids, Dust Bugs or Parastats notwithstanding, you can accomplish a great deal in achieving noise-free reproduction by just plain being careful about how discs are handled. Pick them up by the edge and label only—and not with greasy fingers.

Keep the turntable clean and transfer discs straight from packet to turntable and back again. Above all, don't lay them down on the table or the settee while you look for the plastic sleeve. They're just a couple of the places where dust lurks!

IS IT ARTISTRY OR GIMMICKRY?

In a recent, specially arranged preview, R.C.A. invited record reviewers and other interested parties to hear a new kind of sound, which they described as "Stereo Action."

What the reviewers heard then, and hat you can hear now by buying the iscs, is a demonstration, in part, of what ne well trained panel operator can do ith audio, given a well designed mixing onsole.

But R.C.A. wouldn't like you to think iat this is just another example of ither aimless channel switching, of the ind which reviewers have traditionally eplored, ever since stereo was stereo.

R.C.A. emphasise rather that "Stereo ction" is the result of carefully planned o-operation between musicians, conducor and panel operators, to produce effects which have hitherto been impossible of achievement.

No conductor to date has been able to have his musicians glide from side to side of the stage—no matter how much he would like to do so. To have trumpeters, at the one instant playing side by side, at the next widely separated.

But it can be done by the magic of stereo—not used merely and statically to "locate" instruments of the orchestra, but to move them about in a way which will add to the drama of the music. So runs the theme.

And why not, I suppose, if it's that kind of music? The kind that R.C.A. have in mind for the "Stereo Action" treatment.

More than that it's hardly necessary for me to say. To many, deliberate

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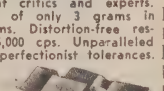

CUSTOM MODEL M7D at £22/16/- also M7N21D at £34/17/6

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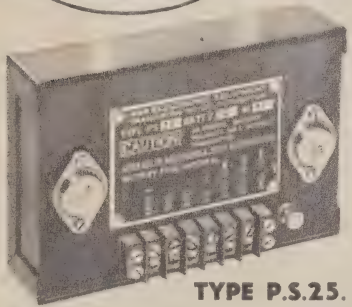

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'mucking about" with mixing controls always will constitute gimmickry, even though the most "respectable" two-channel stereo recordings are like as not compounded from a three-channel original.

To others, some of the sound effects produced by R.C.A.'s stereo action will doubtless be judged as "luvverly," the end thereby justifying the means.

And, of course, there's always the possibility that, given enough manipulation between channels, people using "stereograms" with loudspeakers every bit of 2 inches apart, will hear stereo effects for the very first time!

Discs in the first Stereo Action release include the following:

DYNAMICA. Ray Martin and His Orchestra; Produced by Ethel Gabriel. Stereo Action, R.C.A. S.L. 101096.

SOUNDS TERRIFIC! The Chorus and Percussion of Keith Textor; Produced by George Avakian and Victor Sack. Stereo Action, R.C.A. S.L. 101099.

IT'S MAGIC. Marty Gold and His Orchestra; Produced by Herman Diaz, jun., Stereo Action, R.C.A. S.L. 101097.

BRASS LACED WITH STRINGS. Vic Schoen and His Orchestra; Produced by Lee Schapiro. Stereo Action, R.C.A. S.L. 101098.

Ray Martin's Dynamica is the disc which, to our mind, will have the widest appeal. His style is well suited for this kind of dramatisation and the titles are pure-fire evergreens. My only reservation has to do with a persistent surface crackle, audible during quiet passages.

"Sounds Terrific" is another disc which should be popular. The content is varied but always melodious, while there's just enough percussion and effects to emphasise the Stereo Action idea, without dominating the musical content. The reproduction is very clean but I have to admit again to a spot of surface noise noticeable between tracks.

Good and clean is the reproduction from **Marty Gold's "It's Magic."** Generally tuneful, some of the numbers are additionally dramatised with appropriate sound effects. The "Dream" really walks, and we "Shuffle Off To Buffalo" per medium of a hissing, clanking steam train. You possibly remember these.

"Brass Laced With Strings" is as good a description of the disc as it is a title. The playing is good, the tempos are modest and the titles which, at least, inspire the music are drawn largely from Musicals. In terms of quality, the sound is absolutely clean but a trace of noise here and there removes the surface from the "absolutely quiet" category.

★ ★ ★

"STEREO ACTION" Sampler. Stereo, R.C.A. SPS-15.

For those who may be curious about the "Stereo Action" idea, but not so curious as immediately to lay out the price of a full L.P., this 45 r.p.m. extended play disc is offered. It plays cleanly and well and carries typical selections from the discs reviewed above: "Did You Ever See A Dream Walking," "South Rampart St. Parade," "Kiss Of Fire," "Brass Jockeys" and "The Flight Of The Bumble Bee."

A Review of Sacred Records

THE BEAUTIFUL GARDEN OF PRAYER. Porter Heaps at the Pipe Organ. Mono, Summit (W. and G.) WG-B-1123. (Also available in stereo.)

This disc follows the same basic formula as Porter Heaps' "Beloved Hymns" reviewed in the September issue — well loved Gospel hymns played in a deliberately conservative manner on the studio organ of radio station WGN Chicago.

To mention just a few of the 15 titles, you get "Blessed Assurance," "Near The Cross," "Peace, Perfect Peace," "Sweet Hour Of Prayer," "Holy, Holy, Holy," "Faith Of Our Fathers," etc.

Technically, the disc is well up to standard and thereby scores over "Beloved Hymns," which I criticised in certain respects.

In short, good "background" music for religious gatherings.

★ ★ ★

HE REACHED DOWN HIS HAND FOR ME, Bette Stalnecker, Contralto, with Instrumental and Choral Accompaniment. Mono, Comfort Records (Top Rank) TRL 30077.

So many superlatives are lavished on the jacket notes that everyone having anything to do with this disc would need to have been beyond the limitations of human frailty.

Assessed more objectively, it is a well produced collection of Gospel hymns but recorded at such a level that I fear that some lightly weighted or low compliance pickups will have trouble in playing the louder passages cleanly. The risk is unfortunate, because the quality otherwise is excellent.

Bette Stalnecker, radio soloist from the U.S. Bellevue Baptist Church, has a firm, true contralto voice and sings with the conviction expected of one who has devoted her time to Gospel music. She is backed by piano, organ, vibroharp and guitar, well arranged and well balanced against the voice.

The titles: "When the Saviour Reached Down," "He'll Understand," "Just A Closer Walk," "Wayfaring Stranger," "A City Called Heaven," "We'll Talk It Over," "Precious Lord," "What A Morning Lord," "Hold Thou My Hand" and "With His Love."

★ ★ ★

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He is more than usually proficient also on banjo and electric steel guitar and is efficiently backed by his wife on piano and organ. In short, these two artists, between them, provide interesting and varied entertainment of the "popular" Gospel type. Technically, the quality is excellent.

The titles: "Onward Christian Soldiers,"

(Continued on Page 87)

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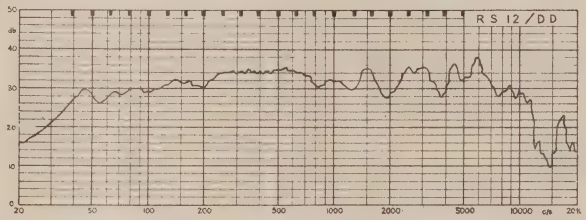

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Total Flux ..... 190,000 maxwells

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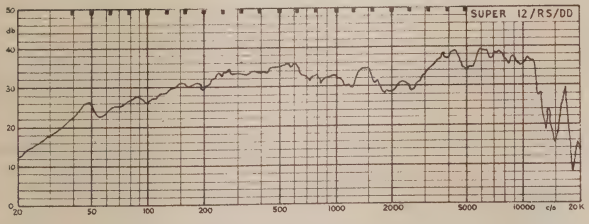

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Recommended.

★ ★ ★

ILL MANN, Lyric Tenor, Directed by Kurt Kaiser. Mono, Word (Gospel Film Ministry) W-3105.

Bill Mann, billed as a lyric tenor but nging well towards a baritone, has one the best voices of any Gospel Singer have yet heard. The accompaniments, ranged by Kurt Kaiser, also warrant ecial mention, ranging from solo guitar an excellent woodwind quintet and the me quintet augmented with strings.

Along with a program that is varied, elodious and sufficiently away from the oo-often-beaten" track, it adds up to a sc which I can highly recommend. And e pressing is as good as the contents: "Somebody Bigger Than I," "Spirit, escend Upon My Heart," "Sunrise," Bleak Winter," "A Closer Walk," Abide With Me," "Jesus Rest Your ead," "His Hands," "In The Hour Of rial," "The Peace That Jesus Gives," A Heart Like Thine" and "Leave It here."

IN VARIED MOOD

HE VERSATILE BURL IVES, With the Anita Kerr Singers and Orchestra directed by Owen Bradley. Mono. Festival FL-30.152.

Sweeping changes in mood and tempo ark this latest Burl Ives release. From e mournful "Long Black Veil," he ments the hardships of the "Forty Hour 'eek," only to explain why "I Walk he Line"; he rounds off side one with e Gospel "Royal Telephone."

As if that's not enough, he's "Shangaied" on side two, in oriental mood, nly to follow with the plea for Lenora "Let Your Hair Hang Down," and ie melodramatic "A Little Bitty Tear."

Altogether there's a dozen numbers demonstrate that Burl Ives is indeed ersatile."

Smoothly backed by the Anita Kerr ngers and orchestra, the disc is well corded and good buying for anyone ith a spot in their collection for a Burl es program.

★ ★ ★

ORGY AND BESS, George and Ira Gershwin. Orchestra conducted by Kenneth Alwyn. Arrangements by Bobby Richards. Produced by Cyril Ornadel. Stereo, World Light Record Club. S7025.

Set in a line of Negro-occupied tenents in Charlestown, South Carolina, bout the year 1912, "Porgy and Bess" ntres around the pathetic romance beveen a cripple (Porgy) and the corrupt ut beautiful Bess. A brief outline of e story is given on the jacket, and a uch fuller treatment in the club's magane.

From start to finish it's hard to fault is latest version. Isabelle Lucas is in ie voice as Bess, Laurence Winters is powerful Porgy and Ray Ellington tes special mention as the gravel-voiced Sportin' Life."

The diction and definition on voice is cellent throughout and you simply on't hear a cleaner or more clearly corded orchestra.

Need I say any more?

THE SENTIMENTAL BLOKE, C. J. Dennis. Complete reading by Robert (Tex) Morton. Two-record album, Mono, Festival. FL30092/3.

This two-record album gets full marks and a bonus in my book.

Dennis' "Sentimental Bloke" is undoubtedly one of the best known characters in Australian literature but he's never seemed quite as alive as he does in this reading by Tex Morton.

To be sure, some of the throaty chuckles are as much Morton as they are Dennis, but, here, they become a virile part of the Sentimental Bloke and his soliloquy. You'll chuckle, too, as you meet "Mar," "The Stror 'At Coot," and "The Pilot Cove."

And technically, this altogether excellent reading is unmarred by as much as a wisp of extraneous surface noise. Recommended.

★ ★ ★

BITTER SWEET, Noel Coward, Bobby Richards' Orchestra, conducted by Kenneth Alwyn. Produced by Cyril Ornadel. Stereo, World Light Music Club, S7026.

The ever-popular lyrics of Bitter Sweet sound almost strange at first hearing, when the voices and orchestration differ from the versions which have been played over the air so many times and for so many years. By comparison, the mood of this new disc strikes one as generally more leisurely, more old-world.

Adele Leigh, Royal Opera singer and British television star, sings the part of Sari. James Pease, American operatic singer has the part of Carl Linden, while rising television artist Susan Hampshire sings Manon.

Smoothly produced and well balanced as are most Cyril Ornadel productions, the disc provides pleasant listening throughout. Technically, it is above reproach, cleanly recorded and with an absolutely quiet surface.

★ ★ ★

"'BIG' TINY LITTLE'S THIRTIES." Tiny Little and His Honky Tonk Piano. Stereo, Coral CRL 757366.

Adding to his growing list of L.P.s, Tiny Little strikes a nostalgic note with these hits from the thirties.

Backed by his own (and appropriately styled orchestra), his nimble fingers reel off a string of old favourites: "When My Dreamboat, etc." "You Must Have Been A Beautiful Baby," "I'm An Old Cowhand," "Rosalie," "Shuffle Off To Buffalo," "Deep Purple," "When I Take My Sugar To Tea," "I Got Rhythm," "Isle Of Capri," "Mexicali Rose," "Lullaby Of Broadway" and "Betty Co-ed."

The quality? First rate.

★ ★ ★

AMERICA'S GREATEST MUSIC MAKERS, Stereo, Festival SFL 930, 135. (Also available in mono).

As an alternative to the above title, one could almost refer to this as a Festival "Sampler." To be precise, it contains individual selections from a dozen popular L.P.s.

What can one say about such varied fare, except to list the artists (spare me listing the titles as well) and to remark that the recording itself is technically good.

Well then, the artists (or conductors): Guy Lombardo, Henry Jerome, Ralph Flanagan, Wayne King, Irving Fields, Carmen Cavallaro, Sammy Kaye, "Big" Tiny Little, Jan Garber, Warren Covington, Tommy Dorsey and Liberace.

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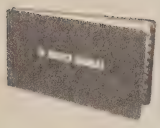

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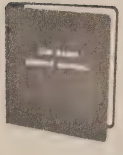

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IN REVIEW—By JULIAN RUSSELL

MEISTERSINGER — "A Rare Bargain"

Wagner—Die meistersinger von Nurenberg. Complete opera. Ferdinand Frantz (Sachs); Gottlob Frick (Pogner); Horst Wilhelm (Vogelgesang); Walter Stoll (Nachtigall); Benno Kusche (Beckmesser); Gustav Neidlinger (Kothner); Manfred Schmidt (Zorn); Leopold Clam (Eisslinger); Herold Kraus (Moser); Robert Koffmaner (Ortel); Anton Metternich (Schwartz); Hanns Pick (Foltz); Rudolf Schock (Walther); Gerhard Unger (David); Elisabeth Grummer (Eva); Marga Hoffgen (Magdelena); Hermann Prey (Nightwatchman). Chorus of the Municipal Opera and German State Opera, Berlin, and Choir of St. Hedwig's Cathedral, Berlin. The Berlin Philharmonic Orchestra conducted by Rudolf Kempe. World Record Club. Mono. XE1116/20.

This economy-priced Meistersinger, and a good one at that, on five 12-inch monos, boxed, with an admirably set-out English-German libretto at £9/19/6 is a rare bargain. Moreover it is the first complete set of the opera ever to be put on general sale on the local market, though "general sale" means, of course, membership of the World Record Club. Previous sets were available only by special indent.

Let us start with what is usually the most important feature in any Wagnerian performance — the orchestra. Under Kempe the Berlin Philharmonic plays deliciously, handling the quieter reaches of the score with almost chamber-orchestra sensitivity yet expanding in both tone and volume in the climactic passages. Although the reproduction is in mono, much detail is audible, and played on stereo equipment one often gets the illusion of spread.

MIGHT HAVE ASSISTED

Here and there stereo might have added to both the clarity and diffusion of some of the more complex passages of the score. One scene which clamours for two-channel communication is the great fugue at the end of Act 2. But since this is so ferociously difficult to bring off even in an opera house (some conductors are content to allow the best-trained choruses to offer only an approximation of what is in Wagner's score) a stereo version might have revealed shortcomings that remain in decent obscurity here.

On the other hand, the final scene, preluded by its exciting brass fanfares followed by massive choruses from the Guilds, and climaxed by the mighty "Wach Auf" chorale is recorded with impressive clarity and richness of tone.

Kempe's reading is splendidly conceived. He deliberately ignores the lesser climaxes, giving them only the weight necessary to carry the musical and dramatic thought on to the one big climax of the act, with enough in reserve to give even a little more to the climax of the whole opera. This may lead to minor disappointments at a first hearing, but further listening will reveal the perfect proportions of Kempe's conception of the work as a whole.

The vocal acting of the singers, is, generally speaking, vividly in character. The proud Junker Walther never sacrifices ardour to arrogance and fairly twitches with irritation when humiliated by the Masters. His voice has consistent allure even in its highest register, and he brings a world of romance to his delivery of the first Trial Song, and later, the famous Prize Song.

Frantz's Sachs is a deeply poetic reading of the wise, benevolent shoemaker who, however, is not without shrewd malice where Wagner has indicated it. He, too, has a fine upper register, both on chest and head notes, and his low tessitura is always rich and full. In only one spot does he fail to carry his audience with him completely — at the climax of the "Wahn, Wahn" monologue in Act 3, and even here the blame might be placed on the conductor's reticence rather than the singer's.

Most of the time Elisabeth Grummer makes a rare charmer of Eva, impetuous, affectionate—and surprisingly enterprising for a 16th-century lass. In a performance so generously enjoyable I feel churlish mentioning that, in my opinion, she overdoes her anger ever so slightly in her second act spat with Sachs. As I wrote elsewhere, for a moment she comes perilously close to shrewishness.

Beckmesser realises all Wagner's spite against his critics without, however, degrading his character into becoming a mere buffoon. The many Masters' characters are sharply delineated and reveal all the composer's genius in being able to describe a character by a few bars of music, and in the case of Nachtigall, in one sung phrase—"Strange is the case."

The Magdalena is never less than eminently pleasing and David sounds really young enough to be an apprentice, a refreshing change from the light tenors who usually fill this important role. All in all I can recommend this fine set with the very greatest enthusiasm, despite its many awkward turnovers, which, alas, in a work of this length seem to have been altogether unavoidable.

★ ★ ★

Sullivan — The Yeoman of the Guard. Denis Dowling, Richard Lewis, John Cameron, Alexander Young, Geraint Evans, Owen Brannigan, Elsie Morison, Marjorie Thomas, Monica Sinclair, Doreen Hume. Pro Arte Orchestra and Glyndebourne Festival Chorus conducted by Sir Malcolm Sargent. H.M.V. Stereo OASD 364/5.

This stereo set improves greatly on the mono issued some two years ago. You need only to play the opening chorus to Act 2 and the Madrigal to note the difference. The balance, too, between orchestra and singers has gained by the transfer, though the new transparency does underline the surprising absence of precision in attack from time to time in the chorus. On the other hand the chorus' beautiful tone and secure intonation are enhanced by the two-channel reproduction.

Although I do not claim to be an authority on the Gilbert and Sullivan operas, I feel I am safe in going on record to state that this is the most successful of the Sargent performances. The Yeoman is fundamentally a more serious work than the others and Sargent's rather too solemn approach which, elsewhere, tends to sacrifice some of the wit, is here better suited to the material.

The rest of the performance is generally excellent if one excepts an overzealous account of Jack Point from Geraint Evans. But Monica Sinclair is there to charm even the most unresponsive listener with her delicious portrayal of Dame Carruthers, and the other soloists are all admirable in their respective roles.

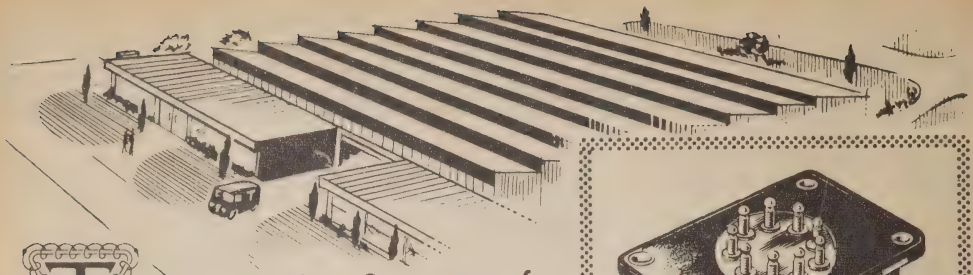
For some reason or other, though every other feature of the sound has been improved in the stereo version, the dynamic range does not seem to be quite so extended as in the mono.

★ ★ ★

Beethoven — Piano Concerto No. 5 in E Flat, Op. 73 (The Emperor). Robert Riefling with the Oslo Philharmonic Orchestra conducted by Odd Gruner-Hegge. Camden. Stereo CAS74. Mono CAM74.

This is the first issue on this economy-priced label to offer a completely new performance. Formerly R.C.A. used Camden for reissuing on LP famous discs, many of them transferred from 78s, that have won great popularity in the past.

At the Camden price of 36/6, both the mono and stereo versions offer an extremely good buy which can be compared most favourably to other performances selling at the usual price of 59/6. Riefling plays the solo part with splendid precision, even at the rapid pace he sustains throughout the final rondo. And he manages, too, despite his speed, to retain intact the rhythmic resilience the movement demands.



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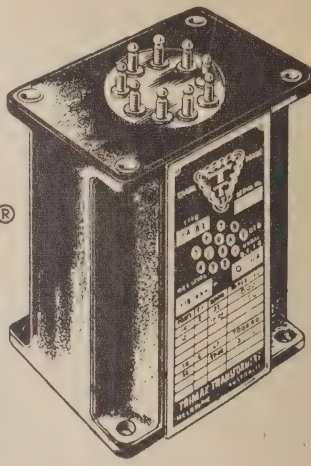

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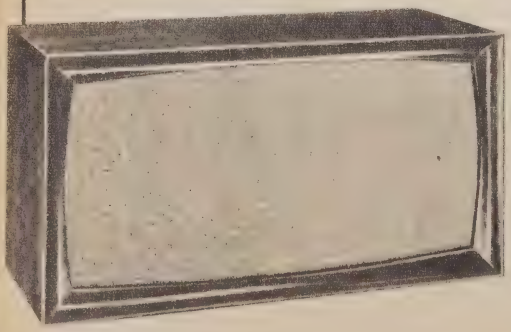

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In the slow movement he employs a velvety touch that I found very beguiling indeed, though some of the poetry in the first movement seems at times to elude him.

The orchestra for the most part supplies highly competent support, though the balance occasionally puts the players at a slight disadvantage. I can, however recommend this disc with enthusiasm to those on the look-out for a budget-priced "Emperor."

★ ★ ★

Beethoven — Symphony No. 9 in D Minor, Op. 125. Orchestra of the Suisse Romande conducted by Ernest Ansermet, with the Chorale de Brassus and Choeur des Jeunes de l'Eglise Nationale Vaudoise. Soloists: Joan Sutherland, Norma Procter, Anton Dermota and Arnold van Mill. Decca Ace of Clubs SXLA2274.

Ansermet and his orchestra are not heard at their best in this performance. Ansermet's reading is always scholarly but, except in the Scherzo which he presents very spiritedly indeed, seldom exciting. He never quite succeeds in communicating all the mystery to be found in the first movement, and a wiry string tone deprives the slow movement of a good deal of its essential richness.

Outstanding among the soloists is Joan Sutherland. She never fails to hit any note she is after squarely in the middle, and her tone remains consistently alluring right up to her top register.

Norma Procter and Arnold van Mill might be described as giving safe oratorio performances, but Dermota shows signs of strain as his voice rises in the scale. It must be remembered, however, that this is one of the most ungrateful tenor assignments in the whole of musical literature, especially that of the nineteenth century.

The chorus is always secure and reasonably well-balanced against the orchestra and the engineering reveals much of the detail in even the most involved reaches of the score. The final quartet is as fine as ever I've heard recorded.

This one-disc performance, which, by the way, has a deplorably clumsy turnover in the middle of the slow movement, faces stiff competition from Horenstein's Vox issue. Personally I prefer Horenstein's account of the symphony, but against that must be set the improved sound on the Decca.

If you're in the market for a one-disc "Ninth" I suggest you hear them both before deciding.

★ ★ ★

Villa-Lobos — The Little Train of the Caipira from Bachianas Brasilieras No. 2.

Ginastera — Estancia (Ballet Suite) and Panambi (Ballet Suite). London Symphony Orchestra conducted by Sir Eugene Goossens. Everest Stereo SEC-930, 044.

The Bachianas Brasilieras of Villa-Lobos are curious works. The composer describes them, not very illuminatingly, as ". . . a special kind of musical composition based on an intimate knowledge of the great works of J. S. Bach and the harmonic, contrapuntal and melodic atmosphere of the folklore of the north-eastern region of Brazil. The composer considers Bach a universal and richly folkloristic source, deeply rooted in the folk-music of every country in the world. Thus Bach is a mediator among all races."

The average listener—and the expert ones, too, for that matter, will find it difficult to detect very much of Bach's influence in any of the Bachianas Brasilieras. The composer's tunes and rhythms are strongly nationalistic and based, for the most part, on Brazilian melodies, as Sir Eugene Goossens points out in the sleeve notes.

But many of the suites have a charm all their own and the "Little Train" is very good fun as an example of musical realism in the manner of Honegger's "Pacific 231," which was hailed back in the early 1920s as a masterpiece of imitation.

The train puffs itself into movement, a tune strongly resembling a Latin American popular dance taking over once it gets going. All manner of exotic percussion instruments accompany it on its journey, producing a rich variety of most unmusical noises. The train comes to a halt with an extra loud bang. It's all as bright as a button.

The Ginastera suites are more orthodox in conception and treatment, with the composer drawing heavily for inspiration on his memories of the Stravinsky of the "Firebird" and "Sacre" periods. But the sounds he produces, despite their burden of debt, are eminently pleasing most of the time and, one imagines, provided effective music as accompaniments to the ballets they were designed to illustrate.

Goossens is usually at his best in this type of music, and this occasion is no exception. The orchestral playing is admirably precise and the clarity of the engineering reveals a wealth of interesting detail in all three works.

★ ★ ★

Berg—Violin Concerto. Andre Gertler and the Philharmonic Orchestra conducted by Paul Kletzki.

Bartok—Sonata for Solo Violin. Andre Gertler. Record Society Mono. 37/6037.

Even the most conservative music-lovers must be finding it difficult to ignore entirely some of the music of such modern composers as Berg, Schonberg, and Webern. Theirs is music which, at the first few hearings, is very difficult indeed to appreciate. And only repeated playing will open up the possibility of its enjoyment.

Here in the Berg Concerto is an excellent chance to become acquainted with one of the most accessible works of this school but I must warn that you must work at it for a while before becoming able to enjoy to the full the many beauties that can be enjoyed on familiarity with its style.

The sound is reasonably good without reaching the very best of modern standards. It has enough clarity and presence to enable inexperienced listeners — after a while — to perceive the direction in which the composer is working. And both soloist and orchestra present splendidly clear-minded accounts of Berg's conception.

Gertler brings to the concerto a warmth that should win response from even the most reluctant of listeners. And he carries this ardour successfully over into his performance of the Bartok unaccompanied sonata. Backing this interpretative illumination is a brilliant technique that can present the most exacting double-stopping with quite astonishing accuracy of intonation.

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Russell Oberlin—Recital. St. Godric Songs. Songs and Ayres by Robert Jones, and Henry Purcell. Lieder by Schumann and Wolf. Festival Mono FC-30, 145.

Russell Oberlin is a counter-tenor, in other words a male alto, a type of voice described in Eric Blom's Everyman's Dictionary of Music as "an artificial extension of the highest male voice register produced by Falsetto, used in Anglican church choirs and in male voice quartets . . . glees and part songs."

The quality of tone, however, is quite unlike a head note used by an orthodox tenor, nor does it resemble the very high falsetto sometimes used in opera buffa. It might best be described as sounding as if it issued from a very grown-up choir boy but with much more resonance and colour.

Oberlin himself, however, claims that his "is simply a natural tenor voice of unusually wide range, a voice which enables him to sing a very extensive repertoire of music for the high male voice." But to me he sounds just like a counter-tenor.

Oberlin controls his voice with magnificent ease, throughout an impressive range and such smoothness that the listener is never worried about any such mishap as a "break" occurring during his long recital.

His choice of program is a little curious comprising, as it does, early English songs and German lieder.

He opens his recital with the St. Godric Songs, described in the sleeve notes as "the earliest known English songs . . . circa 1150." These have a fragile modal beauty enhanced by an "accompaniment" consisting only of a bell-like instrument struck at irregular intervals. The effect of Oberlin's exquisite singing of these fragments is quite enchanting.

He goes on to a bracket of five songs by Robert Jones (1601) in which he is accompanied expertly on the lute by Joseph Ladone, and three Purcell airs for which Paul Maynard and Martha Blackman supply accompaniments on a harpsichord and viol da gamba respectively. These, too, are entirely delightful in content and delivery.

He is not so enjoyable in the lieder where the absence of what passes for passion in a voice lends it an air of immaturity unsuited to such romantic utterances. Every item is beautifully sung yet oddly unconvincing. To me, however, the excellence of the first side makes up for any shortcomings on the reverse — and there might be some who will even welcome the lieder presented as they are here for their novelty.

The sound is of the utmost fidelity throughout.

★ ★ ★

Delibes — Suites from the Ballets Sylvia and Coppelia. Paris Conservatoire Orchestra conducted by Hugo Rignold. R.C.A. Stereo. SL16292.

This beautifully recorded disc should appeal to most tastes. The playing is spirited yet sensitive, and the orchestra tone — if a French tendency to make the horns sound rather too much like saxophones is excepted — always elegant.

Rignold slows some of his tempos in a manner that would be impossible if he had to consider the accompaniment to a ballet in a theatre, but the result is always musical. Indeed this listener found much of the score improved by such treatment.

The Sylvia Suite comprises the Prelude, Les Chasseresses, Intermezzo and Valse Lente, Pizzicato, and Cortege de Bacchus. In the Coppelia you will hear the Prelude, Mazurka, Valse de la Poupee, Czardas, Valse de Swanhilde, and the Ballet de l'Epi.

★ ★ ★

Rimsky-Korsakoff — Suite from the opera Le Coq d'Or. Moussorgsky—Night on the Bare Mountain. London Philharmonic Orchestra conducted by Hugo Rignold. Gem Mono. GEM-30.

At 35/ this is a reasonably good buy though not quite in the first bracket by modern standards. Rignold's handling of the score is a little heavy-handed and rhythmically inflexible. As a result Rimsky-Korsakoff's fairy-tale allegory loses much of its wit and delicate charm though there are movements which come off quite satisfactorily.

The sound is efficient rather than impressive, lacking nothing in clarity, but commonplace tonally. And the performance of Night on the Bare Mountain is as good as you are likely to hear on higher-priced discs.

★ ★ ★

RECOMMENDED

Handel—The Messiah. Jennifer Vyvian; Norma Procter; George Maran; Owen Brannigan. London Philharmonic Orchestra and Choir, conducted by Sir Adrian Boult. Ace of Clubs Mono. ACLA118/120.

Handel—Royal Fireworks Music. Concerto a Due Cori in F Major. Pro Arte Orchestra conducted by Charles Mackerras. Pye Stereo PLC5001.

Khatchaturian—Piano Concerto. Prokofieff—Piano Concerto No. 1. Mindru Katz with the London Philharmonic Orchestra conducted by Sir Adrian Boult. Pye Stereo PLC 5010.

Music of Bach and Handel, played by Karl Haas and the London Baroque Ensemble. Pye Stereo SPLC5005. (The three foregoing discs have already been issued, and reviewed, in mono.)

Bizet arr. Sarasate—Carmen Fantasie. Sarasate — Zigeunerweisen. Saint-Saens—Havanaise. Introduction and Rondo Capriccioso. Ruggiero Ricci and the London Symphony Orchestra conducted by Pierino Gamba. Decca Stereo, SXLA2197. Mono LXTA5571.

Tchaikowsky—Symphony No. 6 in B Minor (Pathetique). Paul Kletzki and the Philharmonia Orchestra. HMV Concert Classic, OXLP20027.

Millstein Encores — Violin solos by Kreisler, Szymanowsky, Schumann, Handel, Mendelssohn and Brahms. Leon Pommers at the piano. Capitol Stereo SP8536.

Mahler—Das Lied von der Erde. Kathleen Ferrier, Julius Patzak and the Vienna Philharmonic Orchestra conducted by Bruno Walter. Decca Mono LXTA5576.

Orff—Die Kluge. Complete Opera. Marcel Cordes (The King); Gottlob Frick (The Peasant); Elisabeth Schwarzkopf (The Wise Woman); George Wieter (The Jailer); Rudolf Christ (The Man with the Donkey); Benno Kusche (The Man with the Mule); The Philharmonia Orchestra conducted by Wolfgang Sawallisch. Record Society Stereo 40-6040/1/2.

Bach—Partitas Nos. 4 and 5. Played by Roslyn Tureck (Piano). Record Society. 38-6038.

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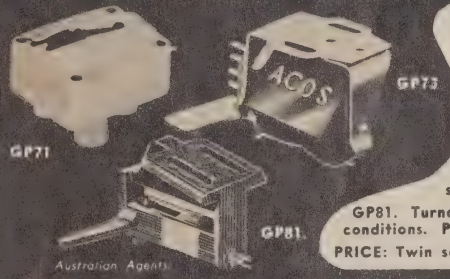

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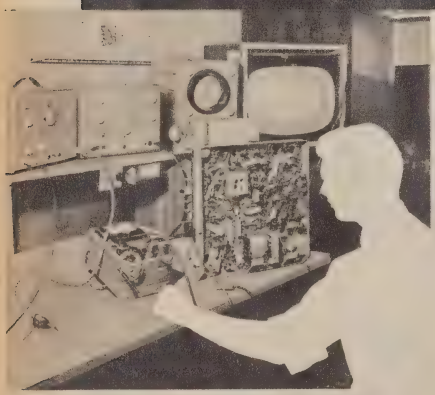

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The second format has been arranged for stations with 144 mc/s multi-element beams.

Besides the above information azimuth bearings are required when the first signal from OSCAR is heard, similar bearings each minute and a final bearing when the signal fades out.

Format 3 covers stations with beams movable in both azimuth and elevation and additional information is required.

Format 4 is similar to 3 but with the addition of Doppler Observations. The full list of information required is quite complex but a few trial runs should smooth out any problems. It is obvious that group operation will be required to successfully comply with logging under Formats 2, 3 and 4.

OSCAR will pass over or near to every spot on Earth four times each 24 hours. Each pass can provide information of value to the OSCAR Association. That means 28 times each week data would be available. Quality of the observation will be of major importance. It is interesting to note that if only 1 per cent of the world's amateurs participate in the project over 5,000,000 data bits will have to be processed.

To expedite the passing of these reports on OSCAR signals, a scheme has been devised using the standard ARRL Radiogram Form. Two methods have been arranged, one for short reports and one for long reports. It is anticipated that the current traffic nets operating in the U.S. will handle much of the information directed to OSCAR HQ at Sunnyvale.

VHF operators who, in the main, will have had little traffic experience, are being requested to contact a local operator who is active in the ARRL's National Traffic System covering all States. Special arrangements are being made in California for terminal points for OSCAR reports. One set of stations will receive incoming CW messages, another telephony messages. RTTY nets will also be in operation directing traffic to headquarters.

More detailed arrangements are now known on the originating of news of the OSCAR launching. When the OSCAR Association receives news that the satellite is in orbit and working correctly, an OSCAR-GRAM will be sent to WIAW, official ARRL Station, via RTTY and CW links that have been specially set up for the purpose. The information will also be repeated to all traffic nets available with a request that it be relayed to other nets.

As the operation proceeds, tracking data will be sent to WIAW as received at Sunnyvale, so amateurs can be kept informed. WIAW will broadcast the news in their regular bulletins. These are readily received in VK on both the 14 and 21 mc/s bands. Times for bulletins are listed each month in QST under "Operating News."

The whole project is planned to make the maximum use of the amateur radio facilities available. It is a venture of the amateur service and a valuable outlet for activity in a project that will provide information of use to scientific organisations.

GENTLEMEN'S AGREEMENT

GENTLEMEN'S agreements between amateurs have played an important part in assisting operation in the various bands. These have been introduced in place of strict regulatory enforcement such as the segregation of CW and telephony stations practised overseas. The outstanding agreement in operation in Australia is undoubtedly the gathering of the CW stations on the low end of the HF bands. At times all amateurs do not observe this arrangement but fortunately they are in the minority. Such agreements do, however, need review from the width of band assigned for one mode. Operating techniques change quite rapidly as one system receives greater support.

Such agreements are observed in many countries a similar CW/Telephony HF band agreement being in operation in Europe. Other understandings cover different phases of amateur operation, such as using Novice Licence segments only when working Novices in the U.S., also spot frequency operation by RTTY stations. The latest GA is the SSB. Foreign station assignment between 14335 and 14350 Kc/s sponsored by the ARRL for W/VE stations. The keeping clear of emergency calling frequencies and official broadcast stations during the presentation of news is another example of co-operation.

It is only by such self discipline that amateurs, irrespective of the type of emission they use, can make the best use of the restricted bands in which they operate. The responsibility of ensuring that new comers to the bands are aware of these gentleman's agreements and the reasons for their adoption rest with the older amateurs. They have undoubtedly contributed to the enjoyment of operating in the amateur service.

A.O.C.P. TUITION

IN addition to the normal oral and correspondence AOCP training courses the N.S.W. division has introduced a tutorial course covering a period of two and a half months. It is for intending amateurs who have a good background of radio theory but who require some intensive study before the AOCP examination. One course was commenced in October to cover students sitting for the January AOCP examination. Full information on the N.S.W. division's classes can be obtained by writing to the class manager, Cec Bardwell, VK2IR, at 14 Atcheson Street, Crow's Nest. The correspondence course is of special interest to persons in areas where it is not possible to attend any club for tuition.

The lecturer at the September meeting of the N.S.W. division held at Science House, Sydney, was Mr Bob Zuker, Engineer from Commonwealth Electronics. He covered for his subject

TOO MANY OPERATING AWARDS?

MUCH comment has been offered in the past of the growing numbers of operating awards. Each month sees a few new ones listed.

Originally the awarding of such operating certificates was in the hands of the various national amateur societies. Perhaps it would have been preferable had their issuance remained at this level. Today many small groups of amateurs offer awards that reflect no special operating ability.

The total number of these awards now available throughout the world is uncertain, but Clif Evans K6BX lists many hundreds of them in his "Directory of Certificates" available on an annual subscription basis, kept up to date by the issuing of three-monthly bulletins of additions. A number of amateurs have gathered over 100 certificates to paper the wall of the shack. Jim Ringeland, W8JIN, was the first to win 200 of these awards. His current tally is around the 250 mark.

You can attain special qualifications in this field by joining the Certificate Hunter's Club and be listed on the Honour Roll on reaching the 100 certificates mark. Many amateurs find the collecting of such awards an interesting pastime.

In order to stabilise the field the Irish National Amateur body the IRTS, submitted a proposal to the IARU. It expressed the view that the number of awards and certificates at present in circulation are not in the best interests of Amateur Radio. It provided for the preparation of a list of awards in good standing which could bear the official approval of the IARU.

Member Societies have voted on the proposal which could do much to stabilise the current trend of issuing awards that due to changes of policy or personnel in small amateur groups, are only available for comparatively short periods. The issuing of awards, especially in any number, is an expensive business and cannot be effectively financed by minor amateur organisations.

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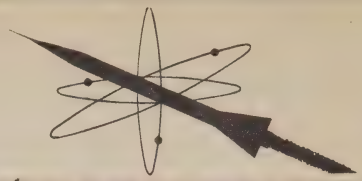

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the use of transistors in communications equipment as RF amplifiers, oscillators, modulators and etc. Transistors in miniaturised gear were shown, together with associated equipment.

The lecture was of topical interest, as so many amateurs are incorporating these devices in their station gear. Slides were used to illustrate the lecture and these have been presented to the division. Mr Zuker has agreed to tape the lecture for the use of clubs, sections, etc., and, together with the slides, will provide an instructive evening to country groups. Some nine technical tapes are now available from the division's library as a free service for interested parties.

The latest membership figures for the N.S.W. division were announced a total of 1170 members, 745 full, 395 associate, 11 life and 11 radio clubs.

AMATEUR OPERATORS

SOME very interesting amateur operating figures are available from the ARRL's Operational Survey of the amateur bands 3.5 to 29.7 mc/s. The survey was presented in the annual report to the 1961 ARRL Board meeting. It was based on an 8,000 card system covering a good cross-section of the amateur population. The survey showed the changing complexion of amateur operation since the last full survey made 13 years ago. At that time there was no 21 mc/s band and no telephony allocation on 7 mc/s. The greatest change, of course; centres around the ever increasing use of SSB which, at the moment comprises 66 per cent of all telephony operation on the 14 mc/s allocation. SSB runs about 50/50 with AM on the 21 and 3.5 mc/s allocations and about 25 per cent of all telephony operation on 28 mc/s. VHF actually has doubled over the 13 years. The following are the overall figures of the expressed use of the various transmission modes on all the HF bands:—

CW — 34.4 per cent, AM — 27.8 per cent, SSB — 23.3 per cent, VHF — 12.1 per cent, RTTY — 1.5 per cent, FM and NBFM — 0.3 per cent, Slow Scan TV and etc. — 0.6 per cent.

VALE VK2UX

NEW SOUTH WALES amateurs were saddened to learn of the passing of a past president of their division Frank Goyne, VK2UX. Frank was the first president on the reoganisation of the WIA in this State after the founding of the IRE in the early 30s. VK2UX also served as treasurer and for a number of years was auditor for the division. Frank had not been active for a period, as he did not enjoy the best of health. He was a life member of the WIA, was an accountant by profession and served in the R.A.A.F. during World War II. The sympathies of all amateurs is extended to his widow.

STATE CONVENTION

THE committee organising the N.S.W. division's State Dural Convention scheduled for the Saturday and Sunday of the Australia Day weekend in January have already made plans for events on both days. They assure amateurs that there will be plenty of interesting features incorporated in the program.

SLOW MORSE

AS from mid October the N.S.W. divisions nightly slow morse practices will be transmitted on a different frequency.

Previously they were to be received on 3525 Kc. From the time mentioned they will appear on 3550 Kc. The practice is presented on a roster system, by which country amateurs using the W.I.A. call sign VK2AWI transmit slow morse from 1930 to 2015 hours E.A.S.T. at speeds varying from five to 12 words per minute. At the end of each session at one speed the text is read back on telephony allowing immediate checking of the copy. These practices are of great value to persons learning the Morse code in Eastern Australia. Army Signal Units also use the transmission for practice purposes. Frank Pearson, VK2ACQ, co-ordinates the service on behalf of the N.S.W. Division.

FEES SUGGESTED

AMERICAN amateurs have always enjoyed licence privileges without the payment of any fee. At the moment it is being suggested that a charge be made for licences for all telecommunication services. Any such proposal will be opposed by the A.R.R.L. for a variety of reasons. Included among them are the following: More than two-thirds of all amateur licence examinations (Novice, Technician and Conditional) are supervised and conducted by the amateurs themselves. The amateur service is largely self-policing by means of official observers (similar to our Advisory Committee) specifically set up for the purpose by the A.R.R.L. Charging a fee for the privilege of spending one's time and money solely to acquire skill in the field of electronics is hardly in accord with U.S. policy of fostering the acquisition of scientific knowledge by citizens, according to a recent QST editorial.

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SPORADIC—E

VHF amateurs in the U.S. are working with the hope of a Sporadic E opening on the 144 Mc band. During extensive 50 Mc openings from E reflections, senior 144 Mc operators have been combing the band for a signal on that band. Two contacts between W1AJR and K9AAJ-1,000 miles and W5LUU and W8KAY 900 miles have been listed as possible working via the sporadic E cloud. At the time there were no weather fronts that could afford a tropospheric opening. It was observed on both occasions that short hop E working was evident at one end of the path only. The pattern of the two contacts was in accordance with what would be expected of a sporadic E QSO at that frequency.

HOSPITAL SHIP

IN just 12 months 5,000 amateur contacts were made by the U.S. hospital ship, s.s. Hope, W8OLJ/PK, while on its mercy trip to Indonesia. Regular communication with home was provided by the service during the first year of its mission for the crew and hospital staff. The people to people project was greatly assisted by the amateur service during several emergencies. Amateurs throughout the world worked with W8OLJ during the stay in Indonesia and the 8,000-mile trip both ways across the Pacific.

SPECIAL AWARD

A SPECIAL award will be made for the highest 7 Mc CW score in the CQDX contest just completed. Despite forebodings caused by the low sun spot numbers, 14 and 21 Mc bands were holding up comparatively well at the start of the VK/ZL DX contest. It is hoped that the conditions will continue for the CQ contest. The final DX contest for the year is the RSGB's 21 Mc telephony contest to be conducted over the weekend, December 2 and 3. DX stations throughout the world work with U.K. stations on that band.

DX-PEDITION

AFTER a period of four years Charlie O'Brien, W2EQS, could not resist the call of another DX-pedition and the novelty of being sought after, as opposed to the answers received under his W2 call sign. Together with DL9KR he went back to his old haunt, St. Pierre, a few miles off the coast of Newfoundland to opera.e as FP8AS in October. With a KWMI and Ranger 2 they operated all bands, 28 to 1.7 Mc on CW, AM and SSB and used 50 Mc as well with an 11 element array.

CONVENTION NEWS

THE two N.S.W. amateur conventions held over the October Six-Hour Day weekend proved very popular, with good attendances recorded at both events. The weather was kind, allowing full activity in the field events. The two conventions were that of the Hunter Branch and the South Western Zone.

The Hunter Branch's annual dinner with 70 members and visitors attending was held at the Esplanade Hotel, Newcastle. The guest speaker for the evening was Neville Williams, VK2XV, Editor of "Radio, Television and Hobbies," who spoke on the many phases of technical journalism. Neville provided interesting anecdotes of his experiences in this field. He displayed Japanese 27 Mc citizen band miniature transistorised equipment and a working demonstration was provided by Bill Hall, VK2XT, from a nearby location.

The formal section of the dinner, was chaired by branch president Stuart Fairbairn, VK2AYF, and speakers included Ray Carter, VK2HC, Divisional V.P. Max Pieffer, VK2MP, Harry Young, P.M.G.'s Department, and Professor J. Radcliffe. Many amateurs from country areas attended the dinner.

The Sunday Blackall's Park Field Day attracted a large gathering including a number of amateurs from Sydney. The field events were well patronised, but local specialist Bill Hall, VK2XT, proved too good for the visitors, winning both 144 Mc events. Under ideal conditions, all attended appreciated the work of the Hunter Branch in organising such a successful event.

The South Western Zone's Ninth Annual Convention was held at Tumbarumba and commenced with a dinner on the Saturday evening. At this function the convention was officially opened by the Tumbarumba Shire President, Cr. O'Keefe. Guest speaker was the W.I.A. State President Bill Lewis, VK2YB. At the completion of the dinner a social evening was held. On the following day the field events were conducted from the showground and resulted in wins for the following: 144 Mc Fox Hunt: First, Eddie Penikis, VK1VP; second, Tim Mills, VK2ZTM. All Band Scramble: First, Bill Lewis, VK2YB, 14 contacts; second, Frank Pearson, VK2ACQ, 13 contacts; third, Ross Weeden, VK2PN, 12 contacts. 144 Mc Hidden Transmitter Hunt: First: Tim Mills, VK2ZTM; second, Keith Dodd, VK2ZAA. 144 Mc Blindfold Hunt Ladies: Tie for first, VK2EY's YL and Frieda Laver, VK2SU; Gents: First, Dave Evans, VK2DE; second, Tim Mills, VK2ZTM.

The members of the Tumbarumba Radio Club were the hosts for this year's convention and visitors spoke highly of the organisation and hospitality shown.

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Extra powerful alnico magnets, handy to have for hobby and workshop 5/6 (Post 2/-)

TANK AERIALS

Copper coated spring steel sections, push together to total 12ft in length. Makes ideal fishing rod. 18/6.
(5/ Delivery to Rail)

MICROSCOPES

Students model, supplies 300 magnifications in three stages 100-200-300. Complete with slides in polished wooden box PRICE NOW REDUCED TO £2/15/-.
(Post 8/6)

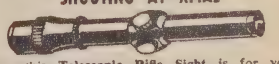
RECORDING TAPES

1,200ft. standard twin tape on 7in spools. 29/6 (Post 3/6)

TELESCOPES

Magnificent instrument supplies 50 magnifications. A delightful gift for student, hobbyist or retired folk. Comes with handy folding tripod. £9/19/6.
(Postage 8/6)

SHOOTING AT XMAS



Then this Telescopic Rifle Sight is for you! It has windage and elevation adjustments, blued lenses, and clamps. NEW REDUCED PRICE £6/15/. (Post 4/6).

PISTOL GRIP SPOTLIGHT

Ideal for shooting, or for car and boat. Available in 6 or 12 Volt.
£4/6/0 (Post 6/)

R.A.A.F. SPOTLIGHTS

Ideal as shooter's spotlight with hand grip, length of flex, and thumb-operated on and off switch. 12 Volt only 39/6 (5/ Delivery to rail).

SEALED BEAM INSERTS

Available in 6 or 12 Volt. Two sizes in each.
6 Volt 4½in 27/6 6in 30/-
12 Volt 4½in 27/6 6in 35/-
(Post 4/6)

MUSIC BOX MOVEMENTS

Make your own Xmas gift music boxes with the quality Swiss movements. TUNES AVAILABLE: The Blue Danube, Limelight, Anniversary Waltz, Lily Marlene. 30/ each.
(Post 1/6).

CARBON MICROPHONE

Complete with cord, plug and socket, and on and off switch. 6/6
(Post 2/6)

DEED BOXES

A must for the careful householder. Supplied with two keys—very sturdy little box. 25/-
(Post 4/)

SPECIAL OFFER, NEW MILLIAMP METER

0 to 1 milliamp meter, shield type (as illustrated). Cheapest possible price to clear large stock. Buy now at 29/6.
(Post 1/6)

CUSTOMERS PLEASE NOTE

Mail Order now for Xmas and obtain your gift items BEFORE the Xmas rush.

512A ELIZABETH ST, MELBOURNE.
(Opposite Victoria Markets)

NEW *Releases!* IN HI-FI TAPE RECORDERS

THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL SPEAKERS.

The amplifier circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

Model TR3 incorporates the new Collaro "Studio" Deck which features:—

- Amplifier using six valves and rectifiers.
- Separate bass and treble controls.
- Monitoring through speaker. While recording.
- High Fidelity. Frequency response 40 to 14,000 cycles at 7½in per second.
- Three 4-pole shielded motors.
- Three speeds, 1-7/8, 3¾ and 7½.
- Fast forward and rewind, 1200ft in 65 seconds.
- Weight 29lb.
- Light piano key controls.

- **PAUSE CONTROL**

This has the effect of stopping the transit of the tape past the "Record Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.

- **TAPE MEASURE AND CALIBRATING DEVICE**

The three digit counter makes the location of any recorded passage the simplest of operations.

- **TRANSCRIPTION TECHNIQUE**

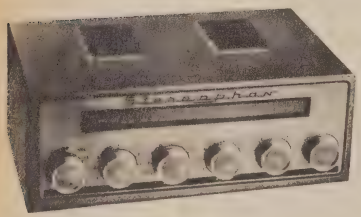
A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE

2 TRACK . . £72/9/0
4 TRACK . . £80/0/0

A COMPLETE HI-FI STEREO SYSTEM FOR ONLY 59 GNS. F.O.R.

UNIT STEREO PLAYMASTER AMPLIFIER No. 2 WITH PLAYMASTER TUNER



—SPECIFICATIONS—

- Output 7 watts per channel (14 watts).
- Ferguson Output Transformers.
- Inbuilt Tuner with new EM 84 tuning indicator, frequency coverage 550 to 1,600 KC.
- Valves 4 6BM8—1 12AUF—1 6N8—1 6AN7—1 EM84—2 1N1763 Rectifiers.
- Supplied in self-contained case finished in beige, hammertone, with black and gold control panel with matching knobs.
- Switching and input facilities for pick-up—radio, F.M. Tuner and Tape Recorder.

PLUS THE NEW B.S.R.-UA12 STEREO CHANGER

AND TWO MAGNAVOX 8W.R. HI-FI SPEAKERS GIVING A FREQUENCY-RESPONSE OF 40 TO 12,000 CYCLES

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD N.S.W. PHONE UA2145

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE RANGE OF STEREOPHONIC EQUIPMENT

Stereophon LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

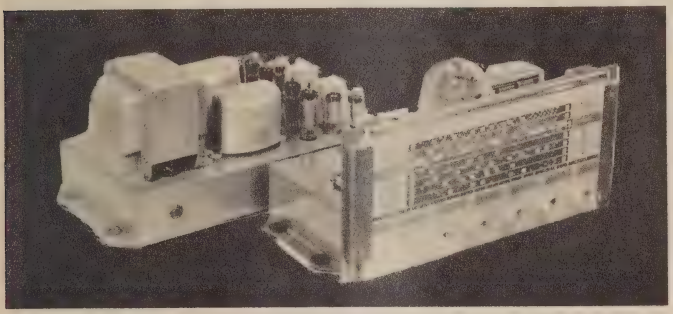
THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles. **£41/15/-** F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

Write for Full Specifications of STEREOPHONIC EQUIPMENT OR TAPE RECORDERS

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial supplied in cream with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

ALL UNITS GUARANTEED FOR A PERIOD OF THREE MONTHS

COMPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

The TELEFUNKEN

STUDIO TAPE RECORDER M24

A studio tape recorder must be highly reliable, it must be convenient to operate and it must give top quality reproduction. The Telefunken M24 recorder has been designed to meet these requirements exactly. Telefunken have been manufacturing studio recorders for 26 years — in fact, they developed the world's first tape recorders, and thousands of Tefefunken machines are in use in studios throughout the world.

The specification below shows why the M24 has become so well known and respected — a product of advanced technical knowledge and manufacturing skill.

SPECIAL FEATURES

All size reels up to 8¾" diameter.

Playing time up to 6 hours.

Rewind time less than 2½ minutes for 3300 ft. tape.

Easily exchangeable plug-in type head assembly.

Separate record and playback amplifiers.

Provision for monitoring input and output while recording.

Recorder can be switched from replay to record without stopping the tape.

Quick start/stop button.

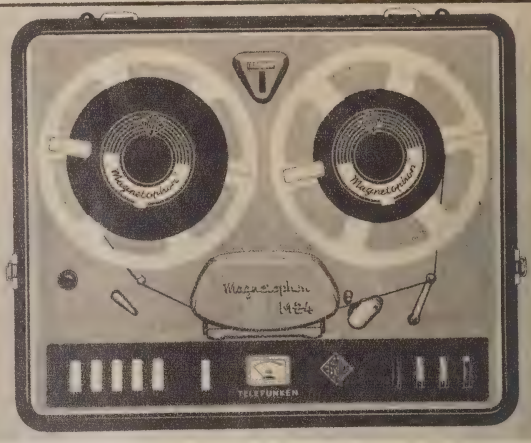
Starting time less than 0.3 sec.

3-digit counter for accurate tape position indication.

Automatic tape end stop needs no contact foil.

Remote control facility gives quick start/stop.

Available in four models—in chassis form, in elegant lock-up wooden cabinet, in portable carrying case with or without loudspeakers.



TECHNICAL DATA

Speeds:
7½ and 3¾ inches per second.

Drive Mechanism:
3 motor (synchronous capstan).

Recording Characteristic:
CCIR.

Heads:
Separate erase, record and replay heads, full track or half track.

Wow and Flutter:-
7½ ips less than ± 0.15% peak to peak.
3¾ ips less than ± 0.25% peak to peak.

Frequency Response:
7½ ips 30 to 18000 c/s ± 3 db.
3¾ ips 40 to 15000 c/s ± 3 db.

Signal to Noise Ratio:
Better than 50 db.

Distortion at full Modulation:
7½ ips less than 3%.
3¾ ips less than 5%.

Level Meter:
Peak reading with db scale.

Input:
4 channel valve mixer —
Channel 1 (microphone): 0.25 mV, 200 Ohms balanced.
Channel 2 (radio): 5 or 15 or 100 mV (switchable) 100 KOhms.
Channel 3 (pick up): 500 mV, 500 KOhms.
Channel 4 (tape): 1 V, 1 Megohm.

Output:
Adjustable (preset) up to 1.2V 600 Ohms balanced or unbalanced.

Monitor:
2 high quality speakers, 6 Watt amplifier with bass and treble controls.

Descriptive information gladly supplied on request.

MANUFACTURERS SPECIAL PRODUCTS PTY. LIMITED

47 York Street
Sydney
Phone: B 0233

ON SHORTWAVE — By ART CUSHEN

SIGNALS FROM ISLAND STATIONS

Broadcasts from Radio Tarawa in the Gilbert and Ellice Islands have been noted on 6050Kc, a channel which this station has been listed to use for many months.

THE reception on 6050Kc. has been only on Friday, and from 0800 to sign-off at 1030GMT. The very strong signals of HCJB on this same frequency is the reason why Tarawa signals have not been received in the past. It would appear the projected power increase for Radio Tarawa is now effective, and the reason for reception being possible, though even now it is difficult to hear the signal under the powerful signals from Ecuador.

The Gilbert and Ellice Broadcasting Service serves some 40,000 population of Tarawa. Two stations are in operation, VTW on 844Kc. and VSZIO on 6050Kc., and plans were for a 2,500-watt transmitter. Reception of this interesting station was first reported by Dick Pollard, of Nelson, N.Z., and I would pay readers to keep a watch on this channel each Friday, when HCJB may be down in strength, due to disturbed reception conditions.

RADIO VILA USES 250W

REPORTED in the issue of last month, the test broadcasts of Radio Vila, New Hebrides, have been continued, and verification from the station gives the power of the transmitter as 250 watts. Radio Vila uses a telegraphic transmitter for these tests in order to find a suitable frequency and also the extent of the coverage before a regular broadcasting service is commenced.

Verification from the Telecommunications section of the Condominium of New Hebrides, at Vila, gives three frequencies on which tests may be carried out on, and all these have since been heard at various times with test broadcasts. The frequencies are 3277, 3905 and 3955Kc. Tests are held midweek, on Wednesday and Thursday from 0700 to 0900GMT, on either of these frequencies.

NEW GOSPEL RADIO

THE Lutherian World Federation has commenced to broadcast from Addis Ababa, Ethiopia, on two 1Kw. shortwave transmitters. The provisional schedule of the station includes services to Asia, Europe and Africa.

1300-1500 on 15315Kc. to India, Pakistan.
1500-1600 on 9540Kc. to Middle East.
1600-1700 on 9740Kc. to South Africa.
1800-1900 on 11970Kc. to Middle East.
1900-2000 on 6140Kc. to Ethiopia.
2000-2100 on 11880Kc. to West Africa.

The station will be pleased to receive reports on these experimental broadcasts, and promises to verify all correct reports on the reception of this new gospel broadcaster in Ethiopia.

BROADCASTS FROM ACCRA

THE phase of radio brodacasting in Ghana in past months has come to its completion with the introduction of programs from the 100Kw. transmitters beamed to Africa. Plans are also to broadcast to North America, Europe and the Far East as soon as the station gets into full operation. The Ghana Broadcasting Service, P.O. Box 1633, Accra, has supplied the following schedule of its transmissions.

National Service:—
3366Kc 20Kw. 0530-0800 1630-2215GMT.
4915Kc. 5Kw. 0530-0900, 1200-2215.
7295Kc. 10Kw. 1200-2215.
9640Kc. 10Kw. 1200-1500GMT.

Special service to Ghananian forces in the Congo, 17865Kc. 10Kw., 1200-1815, and on 15280Kc. 1855-2215GMT. On Saturday to 2300GMT.

The new 100Kw. transmitter is on the air as follows: 6070Kc. 2120-2215, 9564Kc. 1500-1530, 1700-1830, 1915-2215; 11805Kc. 1745-2130, 15285Kc., 2000-2045, 17740, 1415-1645, 1630-1715; and on 21545Kc., 1415-1545, 17800, 1830-1900.

The External service was put in to full operation in October, broadcasts from Tema on four 100Kw., and are intended for listening in Africa.

OAX5U ON 4995Kc

ANOTHER new Peruvian signal which has given good reception in this area is OAX5U, using 4995Kc. This station, as yet unlisted in the World Radio Handbook bulletins, is a new one, and relays the broadcast band station OAX5M. The location is Inca, Peru, and reception has been from 0500 to sign-off at 0615GMT. The station suffers severe interference from WWV on 5000Kc. and Lagos on 4990Kc. for the earlier part of reception. A slogan like "Radio Andes-del-Ica" is used when the station closes, and the theme on closing is a well known classic, better known in its modern form as "Tonight We Love."

MELBOURNE DROPS CALL SIGNS

LATE last month, Radio Australia deleted any reference to call signs in its transmissions in the overseas service from Melbourne. This is not a new practice, as Radio Canada recently did the same, and from now on, reference is made only to the frequency and wavelength on which the program is broadcast.

Recently, Radio Australia released news on the expansions of its shortwave transmitting facilities at Shepparton, which are operated by the Post-master-General's Department. They now use four 100Kw., two 50Kw. and one 10Kw. transmitter. Recently the old VLA and VLB transmitters were remodelled, and from them four 100Kw. modern transmitters were constructed. These, VLE and VLF, are now in operation, VLE from January, 1961, and VLF from September.

Radio engineers of the P.M.G.'s Department have now completed the second stage of development, and the third phase is the building of new aerial switching systems. These transmitters are capable of operation in the 11, 13, 16, 19, 25, 31, 41 and 49 metre bands.

Radio Australia, while deleting reference to call signs, will continue to use the other means of identification which have been established over the years. The station also is to print a new form of verification card, and these will come into use as soon as present stocks are exhausted.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are GMT. Add 8 hours for West Australia, 10 hours for East Australia and 12 hours for New Zealand Standard Times.

RADIO NEW ZEALAND

AN alteration in the frequencies used by Radio New Zealand in Wellington has been made in its service to Australia and the South Pacific, and the broadcasts are now as follows:

0600-0845 Pacific Islands, 6080, 11780Kc.
0900-1145 Australia, 6080, 11780Kc.
1700-1815 Pacific Island, 15280, 11780Kc.
1900-0545 Pacific and Australia, 15280Kc.
0815-0845 Antarctic (Sundays), 6020Kc.

News is broadcast at 0730 and 0930GMT, while the monthly DX Session is heard on the first Wednesday of each month, at 0640 and 1030GMT.

BROADCASTS FROM BRUSSELS

THE new schedule for Radio National Belge in Brussels is now in effect, and offers many frequencies, which can be tuned in this area.

0500-0545GMT Africa, 6000, 9745, 9755 Kc.
0600-0700 Africa, 17860, 17845, 15335Kc.
1000-1200 Africa, 21725Kc.
1215-1300 Southern Europe, 15435, 21510, 21725Kc.
1330-1545 Africa, 21510, 21725Kc.
1330-1600 Africa (Saturday and Sunday), 17860Kc.
1600-1645 North America, 15335Kc.
1600-1645 Southern Europe and Africa, 15435, 17860Kc.
1700-2100 Africa, 11850, 9745, 9705Kc.
2115-2300 North America, 9765, 11850, 6000Kc.
2315-0100 North America, 9765Kc.
2315-0100 Africa, 9745, 6000Kc.

PROGRAMS FROM OSLO

BROADCASTS from the Norwegian State Radio in Oslo are carried for listeners throughout

Hallicrafters Communication Equipment

(Largest range of equipment available in Australia)

Receivers

S107	SX111	SX115	S120
S108	SX112	SX62A	S140
SX110	S95/94	S383	

Transmitters

HT32B	HT40	HA6
HT37	HA2	FPM200

Electronic Keyer HA5

Enquiries:

W.F.S. Electronic Supplies Co.
227 VICTORIA ROAD,
RYDALMERE, N.S.W.

WE ARE THE ONLY TAPE AND HI-FI CENTRE IN THE HEART OF BRISBANE

TAPE RECORDERS: GRUNDIG, PHILIPS, GELOSO, FERROGRAPH
AUDIO: QUAD, TRIO, DECCA, GOODMANS, CABINETS, GARRARD

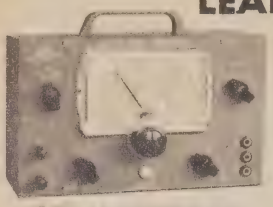
OPEN THIS MONTH:
MODERN SHOWROOM
AND DEMONSTRATION ROOM

TAPETRONICS
1ST FLOOR, ROWES ARCADE, 235 EDWARD STREET, BRISBANE. . . . . TELEPHONE 2 8080

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

LEADER TEST INSTRUMENTS



LSG-10 WIDE BAND SIGNAL GENERATOR

The Leader LSG-10 Signal Generator is an outstanding instrument with world wide acceptance for its exceptional frequency coverage and the biggest value in its class. The range up to 260 M.C.s. covers practically all the requirements of receivers in general use. No need to buy unassembled Kits when you can obtain a factory assembled, wired and tested instrument at practically the same cost.

Specifications.—

Frequency Range (6 Bands)	120Kc to 130 Mc on fundamentals 120Mc 260Mc on harmonics.
R.F. Output	Over 100,000 microvolts.
R.F. Control	Variable with 2 taps.
Mod. Frequency	Approximately 400 cps.
A.F. Output	2 to 3 volts.
A.F. Input	Approximately 4 volts.
Tube Complement	12BH7. 6ARS.
Power Supply	AC. 50cps. 220V. 12W approx.
Size and Weight	16 x 25 x 11.5cm. 2.7kg. (6¼ x 10 x 4½in. 6lb).

New reduced price
£14/10/0 plus 12½% S.T.
£16 6 3 plus freight

LSG-100 POPULAR SIGNAL GENERATOR

A smaller and simplified version of the LEADER LSG-200, this generator is suitable for the amateur constructor and for all-round shop work.

Specifications:—

Frequency Range	400Kc to 36 Mc 5 bands (lowest is band-spread).
Calibration Accuracy	Within 1 per cent.
Output	High, Low and Fine.
Internal Modulation	400 cps approx
External Modulation	Approx. 6 volts.
Tube Complement	6BE6. 6X4.
Power Supply	AC, 50 cps 220 V. 15W
Size and Weight	16 x 25 x 11.5cm. 2.7kg (6¼ x 10 x 4½in. 6lb)

Price £16/16/- plus 12½% Sales Tax
£18 plus freight

LBO-3A OSCILLOSCOPE

UTILITY MODEL

The LBO-3A has been designed for the servicing, testing and maintenance of TV receivers, audio amplifiers and other electronic equipment. It has a wide frequency response enabling the technician to observe all types of waveforms. A stable multivibrator type sweep generator is used for the observation of a single cycle trace up to 150kc. The amplified synchronizing signal controlled by the internal (plus or minus) pulses will "Stop" the traces with positive action. Printed circuitry has been employed for long trouble-free life.

Specifications:—

Response	1.5 cps to 1.5 Mc within 3db.
Input Selector	X1, x 10, x100, accuracy plus/minus 1db.
Calibrating Voltage	0.2V and 1V peak-to-peak. 1V pk-pk at terminal
Horizontal Channel Sensitivity	0.24 Vms per cm (at 1 Kc)
Response	1 cps to 500 Kc, within 3db
Sweep Frequency	10 cps to 150 Kc, adjustable 15.75Kc/2 for Hori TV
Input Impedance	2 Megs shunted by 20 pF
Sync Signal	Int (+ —) Ext. line.
Phasing	0 to 150 deg. adjustable.
Circuit Features	Return trace elimination. direct P-P plate connections Z-axis modulation.
Tube Complement	2-12A17 3-12AU7 1-6U8 1-6X4 1-1X28.
Cathode Ray Tube	3KP1 (1,000V accel., voltage)
Power Supply	AC 50 cps 230V. 55W approx.
Size and Weight	7¼ x 10¼in x 12¼in. (180 x 265 x 310 mm). 17.5 lb (7.7kg).

Price £88/15/- plus 12½ p.c. S. Tax
£99/16/9 plus freight.

LSG-11 WIDE BAND SIGNAL GENERATOR

A general purpose signal generator ideal for testing, checking and experimenting with radio and audio frequency circuits. Calibration accuracy is within plus or minus 1 per cent below 30M.C. and within plus or minus 3 per cent to 390 M.C. It can be used as a crystal oscillator by inserting a 1M.C. to 15 M.C. crystal into the socket provided. No crystal is supplied.

Frequency Range:

Band A. 120KC to 320 KC
B. 320KC to 1,000KC
C. 1MC to 3.2MC
D. 3.2MC to 11MC
E. 11MC to 38MC
F. 38MC to 130MC

Also calibrated harmonics 120 MC to 390 Mc
RF Output 100,000 microvolts maximum.
R.F. Output Control Hi Low Switch, Fine adjuster.
Modulation Frequencies 400 and 1,000 cps.,
AF output adjustable.
Valves used 12BH7, 6ARS.
Power Supply 230 volts AC at 50 cps. 15V.A.
Size 7½ inches by 11 inches by 4½ inches.
Weight approx 6lb.

Price £16/16/- plus 12½% Sales Tax
£18/18/- plus freight.

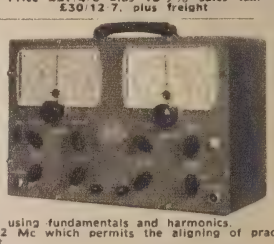
LSG-200 ALL WAVE SIGNAL GENERATOR

The LSG-200 Signal Generator is designed to meet the demand for a high grade and versatile instrument covering wide requirements. The frequency coverage is sufficient for practically all types of all-wave receivers. It is recommended for service benches, assembly plants, schools and laboratories.

Specifications:—

Frequency Range	100Kc to 36 Mc, 6 band (Lowest is band-spread).
Calibration Accuracy	Within plus/minus 1 per cent.
Output	High, Low and Variable.
Internal Modulation	400 cps approx. for 40 per cent depth.
External Modulation	1.5V approx. for 40 per cent Modulation.
Tube Complement	2-6BD6, 6X4.
Power Supply	AC. 50, 220V. 20W approx.
Size and Weight	20 x 30 x 12.5 cm: 42kg (8 x 12 x 5in, 9.5lb)

Price £27/4/6 plus 12½% sales tax.
£30/12 7. plus freight



LSG-531 T.V. F.M. SWEMAR GENERATOR

Newly designed sweep and Marker Generator for use in servicing on TV and FM receiving sets. Used to obtain response curves on an oscilloscope screen. The compact LSG 531 is ruggedly constructed to withstand rough use either on the bench or in field.

FEATURES:—

1. The sweep covers a range from 3 Mc to 270 Mc, in two continuous bands, covers all sound, video and F.M. frequencies, both carrier and L.F.
2. The Marker covers range from 3 Mc to 225 Mc using fundamentals and harmonics.
3. The sweep deviation is very wide, better than 12 Mc which permits the aligning of practically all the TV and F.M. sets on the market.
4. External insertion of Marker signals is possible.
5. A blanking arrangement is used to provide a base line for the response curve on the oscilloscope screen.
6. A 5.5 Mc quartz crystal is supplied with the LSG-531 for extremely accurate marking of the sound channels and for frequency checks. Other crystals in the 1 Mc to 10 Mc range may be used.

Price £78/16/8 plus 12½% Sales Tax £88/13/9 plus freight.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271

BRANCHES THROUGHOUT VICTORIA AND RIVERINA.

the world, and are now carried according to the following schedule:

0600-0700GMT, Home Service to Africa, 25900, 21730, 17825, 11850, 9610 and 6130Kc.

1025-1035, Weather Report to Atlantic, 25900, 21730, 17825, 15175 11850Kc.

1100-1215, Far East Australasia, 25900, 21740, 17825, 15175, 9610, 6130Kc.

1300-1415, Europe, South Asia, 25900, 21740, 17825, 15175, 9610, 6130Kc.

1600-1715, Europe, Africa, 25900, 21740, 17825, 15175, 9610, 6130Kc.

1800-2200, Europe, Africa, 25900, 21730, 17825, 15175, 6130Kc.

2300-0020, South America, 15175, 11850, 6130Kc.

0100-0220, North America, 11850, 9610, 6130Kc.

0400-0520, North America, Pacific, 11850, 9610, 6130Kc.

FLASHES FROM EVERYWHERE

BIAK, in Dutch New Guinea, has been noted at good strength on the new frequency of 3325Kc. at 1000GMT. The station carried a program in Indonesian before this time, and then continued to broadcast in Dutch. Radio Biak also carries the same program on 6075Kc., which is the better of the two signals in this area.

BRAZILIAN signals on the lower frequencies continue to provide some interest, and Dick Pollard, of Nelson, N.Z., has reported the reception of several. ZYJ21 on 3325Kc. has been heard from 0825GMT, ZYS45 on 3365Kc. at 0900.

PARIS, with the transmission to the Far East in English, is heard by Stephen Thurlow, Cabramatta, N.S.W., on 21620Kc. from 1300GMT.

SINGAPORE'S new Cultural network is broadcast from 1030 to 1530GMT, using 4820Kc. The Chinese program formerly on this frequency has been moved to 4780Kc.

CAIRO has made some frequency changes. Its normal Home Service program on 9805Kc. has moved to 9775Kc., while a new 100Kw. transmitter is using 9630Kc. on a test basis with programs as on 9775Kc. The Cairo home program is also carried on 15465Kc. from 1800GMT. The external programs also show alterations, the 17690Kc. outlet to Africa having English 1915-2000 with a sign-off at 2130.

LEOPOLDVILLE, in the Congo, has a transmission to Europe on 11755Kc. This includes programs from 2030-2330 GMT. German is at 2100, Italian 2130, English 2200, Portuguese 2230, French 2250, and Spanish 2315.

BAGHDAD, in Iraq, has retimed its session in English, and this is now on the air from 2100 to 2200GMT, using 6030Kc. The Home programs from Baghdad in Arabic have in the past been carried on 7180Kc., but an additional outlet has now been added, this one operating on 5960Kc.

NORWAY'S low-powered transmitter LKJ, using 6130Kc., has been heard in the afternoons, when it has a program from the Home Service of the Norwegian State Radio. The station opens at 0600 on weekdays and 0700GMT on Sundays, and the power is reported to be 200 watts.

AFGHANISTAN station Radio Kabul is now using two frequencies for the session in English and Urdu. The station is on 4040 and 4710Kc., and has a program in Urdu 1330-1400 and in English 1400-1430GMT. A program in Russian 1730-1800, Arabic 1800-1830, and French 1830-1900 is carried on 15225Kc., with the transmission beamed for listeners in Europe.

CANARY ISLAND station "La Voz de la Isla de la Palma," in La Palma, uses 7850Kc. with 350 watts, and is on the air 0800-0900, 1200-1500, 1900-2300GMT. Sundays 1200-1500, 1900-2300. The station is planning to enlarge its transmitting site, and at present its broadcasts are of a local and regional style.

JORDAN'S broadcast from Amman to listeners in South America has undergone a frequency change, and is now carried on 15345Kc. The service is on the air 2300-0100 in the overseas service of the Hashamite Broadcasting Service.

CONGO station in Brazzaville has been observed in North America on 15190Kc., opening at 1900. The station has music to 1930, when news in English is presented, and lessons in French to follow the news bulletin.

BECHUANALAND broadcasts from ZNB Mafeking, operating on 5900Kc. with 1Kw. is on the air 1100-1200, 1700-1930, and has news relayed from Radio South Africa at 1115 and 1715GMT. The station address is P.O. Box 252, Mafeking.

PUERTO RICA is another country soon to have a shortwave station. U.S. listener Ken Boord informs us one is to be put into service before the end of 1961.

HAITI station 4VEH is using 6107, 9772Kc. on shortwave, and the broadcasts have been heard from this Cap Haitian station at 1030GMT on 9772Kc.

BELGRADE, in Yugoslavia, now has three daily transmissions in English, and reception of these in this area at the moment is possible on the two earlier transmissions. The first broadcast is 1530 to 1600GMT, on 15240, 11735 and 9505Kc., 1830 to 1900 on 7200 and 6100Kc., and the third transmission from 2200 to 2215 is on 9505, 7200 and 6100Kc.

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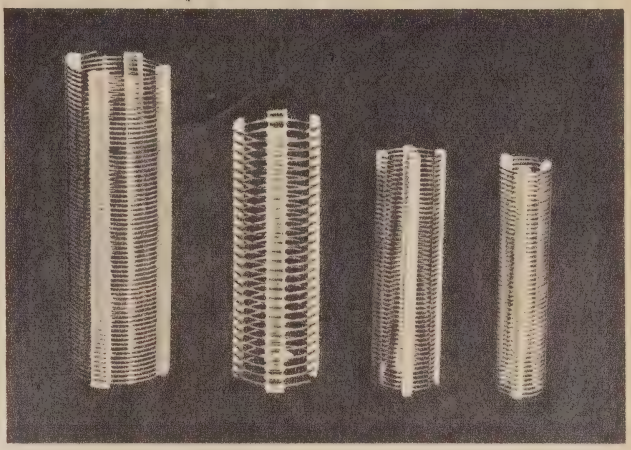

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No. 3-16	½"	16	3"	No. 3011	7/4
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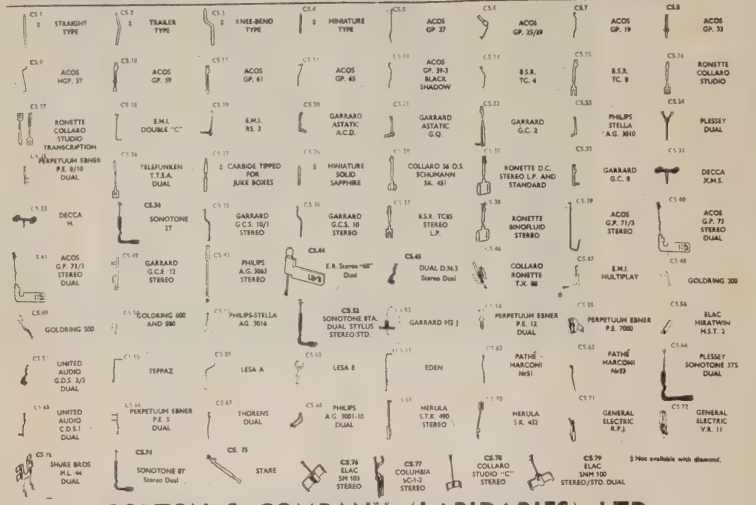
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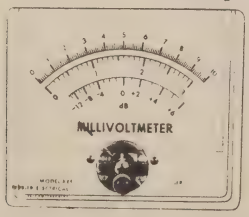

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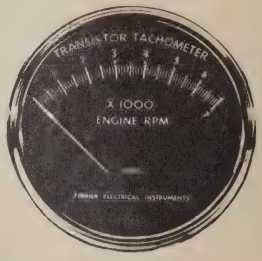

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ANSWERS TO CORRESPONDENTS

C.P. (Wyalkatchem, W.A.) writes to say that he has recently passed the A.O.C.P. exam., which he attributes to a large extent to our past articles on the subjects concerned. He suggests that we continue to publish past A.O.C.P. exam. papers for the benefit of intending candidates, including worked answers.

A: Thanks for the letter, C.P., which we read with interest. We are always glad to hear that our articles prove interesting and helpful. Wherever it is possible, we will try to continue publishing questions and answers of each A.O.C.P. examination, but as you no doubt realise, this will be governed by space considerations.

Incidentally, the number of resistors in the non-inductive load shown with the recent Standing Wave Ratio Bridge will depend upon their value. The required number may be calculated from the normal "resistors in parallel" rule.

★ ★ ★

B.E. (Terang, Vic.) asks if we would consider publishing a design for a fixed-tuned receiver for use by fire brigades, etc., on their mobile equipment. He also asks if we would advise the alterations to the June, 1955, "Shortwave Converter" to enable it to function in a car.

A: For a suitable fire brigade receiver, B.E., we would refer you to the Bushfire Radio described in the November/December, 1953, issues. Regarding the converter, it would be possible to use this by simply adding a vibrator or transistor power supply. If it is desired to adapt the circuit to hybrid or battery valves, we would suggest that you refer to the "Battery SW Converter" of February-July, 1958, and the "1959 Karset" of June, 1959, for the techniques involved.

★ ★ ★

B.L. (Claremont, Vic.) refers to the article on "Sound for 8mm Movies" of September, 1960, asking if he would be able to add sprockets to his tape recorder so that he may use it to run fully-coated film in synchronism with his projector. He also asks whether it is possible to obtain a magnetic sound head with a circuit for the amplier required, in order to add magnetic stripe sound to his existing projector.

A: The idea of just "adding a few sprockets" to a tape recorder to enable it to handle perforated tape or fully coated film is not the simple scheme it may appear, B.L., due to wow and flutter problems. Basically, all trace of tape or film jerk introduced by the sprocket teeth must be removed while it moves past the heads. As a look at a commercial perforated tape machine will reveal, this usually involves a heavy tape-driven flywheel stabiliser (or two), together with tight- or free-loop isolation rollers.

The idea is a good one, and will usually result in high performance if carefully done, but as you may gather the task is not as simple as it may appear.

As for the stripe attachment for your projector, we are afraid that we cannot help at present in terms of a circuit, etc. Regarding a suitable magnetic head, we would suggest that you contact Magnetic Products Pty. Ltd., 4th Floor, Adams Hotel Building, 484 George Street, Sydney.

We should like to add at this point that we are at present investigating the position regarding the mechanical and electrical side of such an adapter, and hope to present details of a stripe adapter (if we are successful) some time in the future.

★ ★ ★

J.W.H. (Potts Point, N.S.W.) says that he has seen references to a scheme which involves using a television tuner, with a 12AT7 supplementary converter, to change the output of TV station sound to the 88-108Mc. band. From here, it can be resolved by a standard FM tuner. The references are "Radio-Electronics" June, 1957, and "Audio" April, 1956.

A.: We don't remember either of these references but even if we saw them at the time, it is doubtful whether we would have taken too much note of them. Even now, against the present background, it is difficult to generate much enthusiasm. If one had to use a TV tuner plus supplementary circuitry, it would probably be better to go the second mile and add a TV IF system, to come out with drift-free intercarrier sound — not using the FM tuner at all. The trouble is that TV sound that qualifies as high quality audio program material is not plentiful.

J.W. (Oaklands, N.S.W.) asks if we would explain the various modes of valve operation in the "Answer Tom" section of the magazine. He says that he feels that the "Tom" and "Answers to Correspondents" sections should be larger, and wonders why these sections were reduced recently. This, he feels, is the cause of delayed answering of questions by readers.

A: We will certainly file away your suggestions regarding the "Answer Tom" section, for possible use when the present series of instrument articles reaches an end. As for the space devoted in the magazine to this section and the answers pages, we're afraid we can do little to help. At present, these sections must be limited to a certain extent by the dictates of available space and staff time. We do our best to ensure the minimum delay in answers, so we must ask your patience!

★ ★ ★

T.R.M. (Wambool, Qld.) sends us news of his recent projects, and his success with them. He also relates some experiences with a commercial amplifier, and adds that he has constructed many of our projects over the years, generally with quite good results.

A: Thanks for the letter, T.R.M., which we read with interest. It's pleasing to hear of your successes, which we hope will continue.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies , but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

(8) Technical queries are not answered by telephone.

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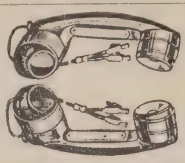

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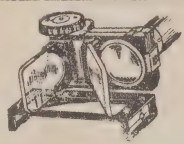

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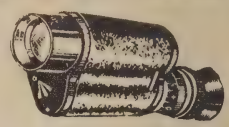

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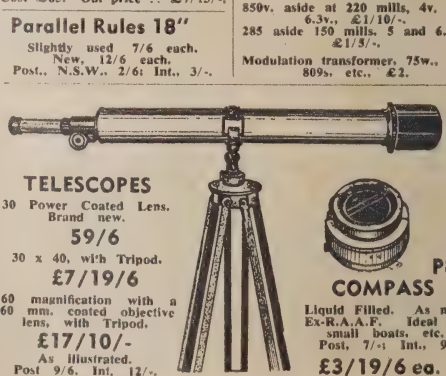

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REBUILDING HUMAN BODIES

Continued from Page 14.

There is a case on record where a soldier during World War II had his face shattered, together with the loss of his tongue, which was torn away, leaving only the roots.

After a series of operations which remade his face and jaw bones from cartilages taken from his chest and skin taken from various parts of his body, a new tongue was provided by taking skin and tissue from his back via his arm by the "stalk" process described above.

The patient's arm was finally brought to his mouth, where the end of the unrolled stalk was sewn to the roots of his tongue. After it had become properly attached, it was severed from his arm and the tongue moulded into shape. The patient soon learned to talk intelligibly and eat and drink in a normal manner.

Experiments have been going on for a number of years into the possibility of transplanting organs from one living being to another. There are many difficulties in the way of success, though promising techniques are under study. During the research, for example, a peculiar property of living tissue was discovered. This relates to what is termed "embryonic tissue," or tissue of the embryo of any living animal.

In the early stages of the embryo, the cells are identical in every way. At a later stage, they develop into rudimentary cells of the future skin and others into the rudimentary cells of the nervous system called the neural plate.

Scientists know just when these rudiments appear in a frog's embryo and have made use of this to carry out some interesting experiments.

They know just where the skin rudiments and neural plate rudiments should appear. They took some cell tissue from the site of the future skin and transplanted them to the site of the future neural plate. Normally one would expect the skin to grow where the neural plate should be, like a normal skin graft, and vice versa. This did not happen. The skin cells changed to neural plate cells and the neural plate cells developed into skin cells.

Scientists now think that this may in future be a way to regenerate old organs or grow organs which are lacking. Perhaps in time to come we will be able to grow new arms, legs and even brains by the transplanting of embryonic tissue.

REMOTE CONTROL FOR TV

Continued from Page 53.

speaker area in the approximate pattern shown. Drilling should be from the front of the box, since there is a risk of slight chipping as the drill emerges.

The speaker has no direct mounting facilities, being intended for direct connection to printed wiring boards. We mounted it by clamping between the front of the box and the rear cover, a small pad of foam plastic serving to pack the small gap between the magnet and the cover. Lateral movement of the speaker is prevented by four small blocks cut from the waste material of the case and glued at equally spaced intervals around the circumference.

The rear cover may be made from punching bakelite or light gauge aluminium, held in place with four screws. Holes for the screws are drilled and tapped into "pillars" moulded into each corner of the box for just this purpose. It is also a good idea to drill a few holes in the cover, behind the speaker cone, to prevent the reproduction from sounding too "boxy."

To protect furniture and also to reduce the risk of the unit being accidentally brushed off the arm of a chair on to the floor, four small rubber feet are fastened to the rear cover. These may be made from grommets or cut-down gang-mounting rubbers, fixed to the cover with any suitable household glue or cement.

The cable is brought into the box at one end, and it is a good idea to make the hole a little on the small side, so that the cable is a neat push fit. In conjunction with some form of clamp inside the case—even a loop of tinned copper wire soldered to an unused contact—this will prevent undue straining or twisting.

There are several varieties of miniature earphone jacks on the market, and care should be taken to select one which will suit the plug on the particular earphone to be used. It is mounted in the end of the case opposite to that used for the cable entry, and this is a convenient spot which keeps the earphone cable well out of the way.

The controls on the front of the box may be identified by means of transfers which are available from at least one manufacturer. Although originally intended for our previous control unit, enough letters are available to enable the function switch to be marked as shown.

ELECTRONIC ORGANS

Continued from Page 37.

THE ELECTRONIC MUSICAL MANUAL INSTRUMENT, by Alan Douglas. Price £2/12/6. (4th edition available soon.)

THE ELECTRICAL PRODUCTION OF MUSIC, by Alan Douglas, 1958. Price £2/2/6.

HOW SCHOBER ORGANS WORK, by R. H. Dorf, 1960. Price 5/. (Good value.)

ORGAN BUILDER'S MANUAL, by R. L. Eby. 4th edition, 1960. Price 16/6. (Basically a catalogue but containing much useful information.)

KINSMAN ELECTRONIC ORGANS, 1958. Price 2/6. (Reprint of an article in "Electronics.")

See also standard texts such as RADIO ENGINEERING HANDBOOK (Henney), MUSICAL ENGINEERING (Olson), THE RECORDING AND REPRODUCTION OF SOUND (Read), and PSYCHOLOGY OF MUSIC (Seashore.)

See also bibliography of magazine articles to 1954 in ELECTRONIC MUSICAL INSTRUMENTS (Dorf.)

See also "Radio, Television and Hobbies," for May, June, August, September, October, 1955.

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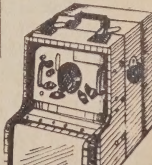

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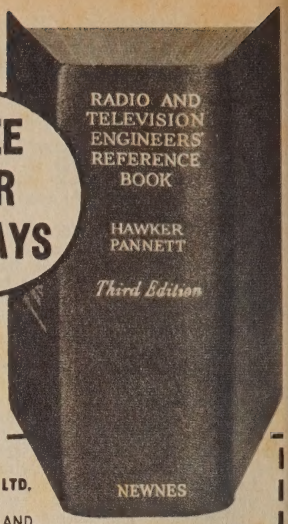

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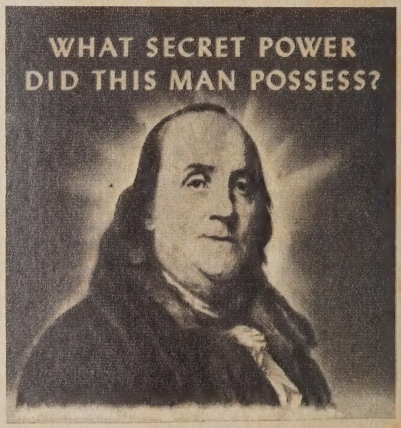

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TRANSISTORS RIDE THE OUTBOARDS

(Continued from Page 11)

will be relatively short, and the average charge rate held at a value which will supply the load and charge the battery if necessary.

Again, if a battery is in a partly discharged condition, with no load, and the engine running at high speed, it is still possible that the voltage developed across the battery may rise sufficiently to open the field circuit. But, because the battery is only partly charged, it will be unable to maintain this voltage, so that, once again, we have a short "off" period and an effectively high charging rate.

(All these operating conditions are based on the fact that a battery may safely be charged at a very high rate when it is in a discharged condition, but must be charged at a progressively lower rate as the state of charge advances.)

So far, no mention has been made of a reverse current circuit breaker (cut-out) or a current-limiting device, both of which are included in the more familiar or conventional voltage regulator. The diodes in the charging circuit in reality perform the function of the reverse current circuit-breaker, in that the nature of their construction prevents current flow in the reverse or opposite direction. The key switch serves to break the field circuit when turned to position "off."

Current-limiting is accomplished automatically by design of the stator windings (wire size, number of turns, etc.), which is such that a definite ratio has been established between the induced stator current (charging) and resultant opposing inductive reactance (impedance) throughout the operating r.p.m. range.

Finally, there is the problem of transient suppression. It is well known that whenever an inductive circuit is broken, as by the action of vibrating regulator contacts or ignition breaker points, an opposing or transient voltage is induced in the respective windings and/or wiring system. This can cause damage to the particular unit unless provision is made for its dissipation.

The circuit shows two diodes whose function it is to suppress these transients. One is marked "suppression diode," the other "field discharge diode." There is also a capacitor across the diode bridge network.

The manner of operation of these diodes is not hard to follow. Assume we have a steady DC voltage applied to an inductive device, such as the field winding, and that this circuit has to be abruptly broken in the normal course of operation. While ever the steady voltage is applied to the winding, a steady magnetic field will be maintained around the winding but, immediately the circuit is broken, this magnetic field collapses.

It is this collapse of the field which creates the transient; a pulse of voltage which will be many times greater than the original voltage, and which can quite easily damage the associated components, particularly the transistor.

The diode is connected in such a polarity that it offers a very high resistance to the low applied voltage, but, by reason of its "zener" characteristic, a very low resistance to the induced transient of high amplitude.

The function of the capacitor across the bridge rectifier is mainly precautionary. In the event that the battery may be accidently disconnected from the charging circuit, as for example by a "blown" or defective fuse, dangerously high peak voltages could be generated across the rectifiers. The capacitor reduces these to a harmless level, acting in much the same way as a filter capacitor in a conventional radio power supply.

Thus we have a charging system in which the prime source of power, the alternator, has no moving contacts or complex drive mechanism and so should require an absolute minimum of maintenance. The control circuit, which would normally require 3 sets of contacts — current regulator, voltage regulator, and cut-out — now has only one set of contacts, and these carry only a very small current. Surge suppression is very effectively provided for and, in the normal course of events, the entire system should have a long and trouble-free life.

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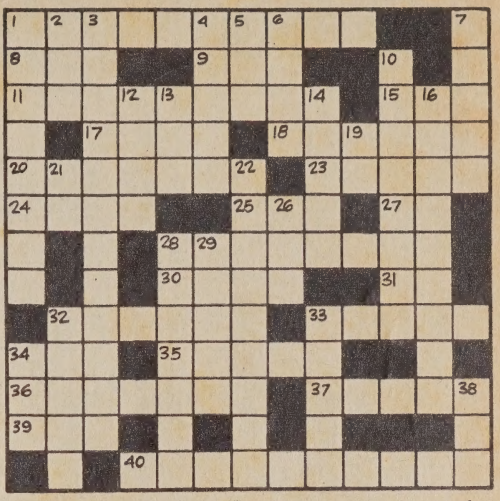

ACROSS

1. A non-conducting medium.
8. Time.
9. Hurry.
11. Sure thing.
15. Greek letter.
17. Cut.
18. With the conductors connected end to end.
20. Having two magnetic poles.
23. Where the bride walks.
24. Electric fish.
25. Organ.
27. Direction.
28. Converting a picture into a series of changes of voltage.
30. Agreement.
31. Hesitation in speech.
32. Severe.
33. Mineral.
34. A friend in France.
35. The capital of Tibet.
36. French tennis champion.
37. It comes once every 24 hours.
39. To deaden speaker enclosures.
40. The change in a condenser's apparent capacity due to the displacement of the electrostatic field at the outer edges of the plates.

DOWN

1. Units of sound level.
2. Professional institution.
3. Deafening.
4. Country.
5. Prepare a soldering iron.
6. Exposes hemp.
7. The portion of a cycle through which an alternating voltage or current has progressed.
10. Type of oscillator.
12. Town in New Mexico.
13. Tool.
14. Wish for.
16. Means of communication.
19. Stands for an American State.
21. That is.
22. Opposition to current flow due to inductance.
26. Six-footer.
28. Upset.
29. Hiding place.
32. Slander.
33. Canadian tourist resort.
34. Everybody.
38. Small child.

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